Programme Area: Smart Systems and Heat

Project: Developing Knowledge from Data

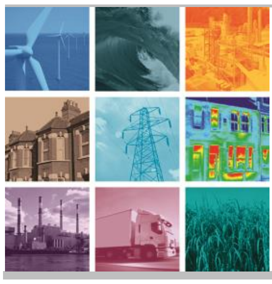
Title: An analysis of national travel survey data to inform estimates of heat demand

Abstract:

Travel diary data from the National Travel Survey was used to identify the home occupancy patterns of survey participants. By tracking the journeys of individual household members through their travel diaries it is possible to establish the times at which they were at home. Aggregating the individual members of a household can then give the occupancy level of the house through the diary week. Depending on current heating patterns, houses with lower occupancy levels may offer the greatest opportunities for energy savings whilst maintaining comfort levels by matching heating times to occupancy patterns. Occupancy in houses with fewer residents is likely to be easier to predict so the need for remote heating control may be reduced. In larger houses with larger numbers of residents it will more difficult to predict occupancy. Interest in remote heating control may be increased. The amount of time that these houses are empty is significantly less so the benefits of matching heating times to occupancy are reduced. In larger, multiple occupant houses the potential benefits of zonal heating controls will be larger. This would give the ability to heat the areas of the house that are occupied at any one time rather than the whole house.

Context:

As part of its Smart Systems and Heat programme the ETI is developing EnergyPath Networks which is a software tool that will be used to develop future local area energy system designs to meet 2050 carbon emission reduction targets. The tool requires data in order to estimate current and future energy demands, and to assess the relative costs and merits of technologies.



Analysis of National Travel Survey Data to Inform Estimates of Heat Demand

Executive Summary

As part of its Smart Systems and Heat (SSH) programme the ETI is interested in understanding when homes are occupied. This has relevance for:

1) The setup of Home Energy Management (HEMS) systems to achieve comfort in the most efficient way.
2) The design of local area energy networks where knowledge of demand patterns is essential.
3) The design of building retrofit solutions.

Travel diary data from the National Travel Survey was used to identify the home occupancy patterns of survey participants. By tracking the journeys of individual household members through their travel diaries it is possible to establish the times at which they were at home. Aggregating the individual members of a household can then give the occupancy level of the house through the diary week.

The analysis provides quantitative data to support qualitative preconceptions. The main points of interest are:

1) Occupancy is highest overnight (from 6:00pm to 6:00am) and lowest in the middle of the day with minimum occupancy between 11:00 am and midday.
2) At the 11:00am peak on week days around 50% of houses are empty with around 30% partially occupied and 20% fully occupied.
3) Around 10% less houses are empty during the middle of the day at weekends than on week days.
4) People tend to leave home around 1 hour earlier and return 1 hour later on week days.
5) More houses are empty overnight at weekends (nearly 20%) than on week days (around 13%).
6) Attendance at school and work is lower at weekends.
7) Occupancy patterns do not change between seasons with summer and winter occupancy times and levels showing only minor differences.
8) Few homes are empty for more than 12 hours a day unless they are empty for 24 hours or more. Around 10% of homes were identified as empty for 24 hours or more.
9) Times of occupancy within individual households are highly variable.
    a. Variability is larger on week days than on weekend days.
    b. Return home times are more variable than home departure times.
    c. On a week day arrival and departure times are likely to vary by hours rather than minutes.
10) The homes of retired people have different occupancy patterns to those of younger people.
    a. Retired people are more likely to be at home during the day.
    b. Retired people are more likely to be at home in the afternoon.

c. Retired people tend to be out of the house for shorter periods of time.
d. The homes of retired people are more likely to be empty overnight.

11) It is difficult to separate the relative influences of house size and number of residents in occupancy patterns, However,

a. Smaller houses and those with lower numbers of residents are more likely to be empty and are generally empty for longer periods of time.
b. Flats are most likely to empty at least once on all days of the week with detached and semi-detached houses least likely to be empty.
c. The most common length of time for houses with 1 resident to be empty is 9 hours. For houses with 4 or more residents this reduces to 6 hours.

Depending on current heating patterns, houses with lower occupancy levels may offer the greatest opportunities for energy savings whilst maintaining comfort levels by matching heating times to occupancy patterns. Occupancy in houses with fewer residents is likely to be easier to predict so the need for remote heating control may be reduced.

In larger houses with larger numbers of residents it will more difficult to predict occupancy. Interest in remote heating control may be increased. The amount of time that these houses are empty is significantly less so the benefits of matching heating times to occupancy are reduced. In larger, multiple occupant houses the potential benefits of zonal heating controls will be larger. This would give the ability to heat the areas of the house that are occupied at any one time rather than the whole house.

Contents

Introduction

The National Travel Survey is conducted annually by the Department for Transport. It takes the form of a week-long travel diary completed by all participants. This diary includes information on all domestic travel completed by members of participating households in the diary week. The following data is included in each diary entry:

1) Travel mode
2) Journey start time
3) Journey end time
4) Journey start location (origin)
5) Journey destination

Information is also collected about the participating households. Of particular relevance to SSH are:

1) House type
2) House location (by Government Office Region and also on an Urban to Rural basis)
3) Household size and structure
4) Participant age
5) Participant work status

By tracking the journeys of individual household members through the diary it is possible to establish the times at which they are at home. Aggregating the individual members of a household can then give the occupancy level of the house through the diary week.

Information on the times and levels of house occupancy is valuable to SSH to:

1) Help estimate heat demand for building retrofit and energy network design, and
2) Inform development of HEMS control strategies.

This report gives the results of this analysis based on survey data from 2003 to 2010 inclusive. Data from households classified as 'fully co-operating' was used giving a data set containing around 2.25m journeys from nearly 64,500 families. The number of diary days is approximately 450,000. Approximately 10 % of original survey participants are classified as 'partially co-operating'. Larger households with 3 or more adults or 2 adults and 3 or more children are more likely to be classified as partially co-operating as shown in Table 1.

In addition households which are not working (unemployed, students, looking after relatives etc.) are more likely to be classified as partially co-operating (13% of these households). Retired and permanently sick households are least likely to be classified as partially co-operating (7% of these households).

Household Structure	Household response status	
	Fully co-operating	Partially co-operating
Single adult 65+	93.8%	6.2%
Single adult 16-64	91.4%	8.6%
Two adults, Hoh/HRP 65+	93.4%	6.6%
Two adults, Hoh/HRP 16-64	90.2%	9.8%
Three or more adults	82.4%	17.6%
Single parent family	86.8%	13.2%
2 adults, 1 child	89.2%	10.8%
2 adults, 2 children	89.4%	10.6%
2 adults, 3+ children	88.0%	12.0%
3+ adults, 1+ children	85.4%	14.6%

Table 1: Breakdown of household co-operation in the National Travel Survey data.

Analysis in this report is restricted to occupancy levels. Comparisons of current measured energy use from other surveys to the occupancy patterns shown here may give an indication of the potential energy savings which could be realised by improved heating controls.

1 The Location of People at Different Times of Day

In order to estimate the location of heat demand through the day the diary data was used to establish the location of people during the day as shown in figures 1.1 and 1.2.

The influences on heat demand times and locations are:

1) People tend to be at home later in the morning at weekends
2) More people are at home during the day at weekends
3) More people visit friends at weekends (there is some evidence that people heat their homes more when entertaining visitors).
4) Attendance at school and work is lower at weekends.

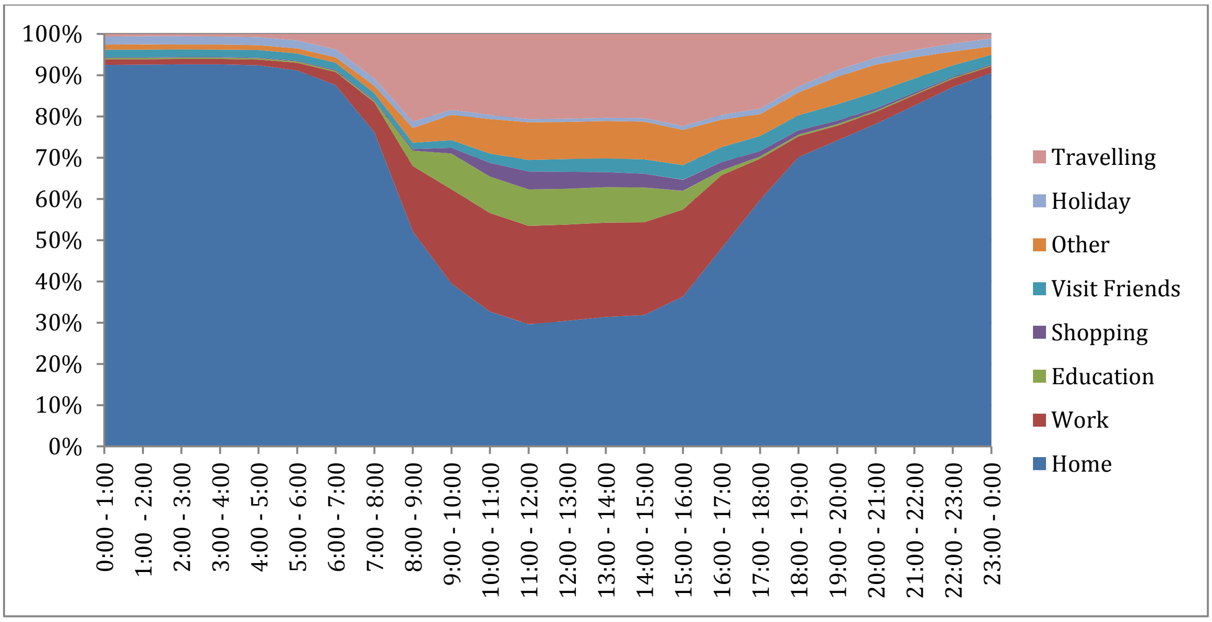


Figure 1.1: NTS participant location by time of day on week days (sample size: 150,100 people)

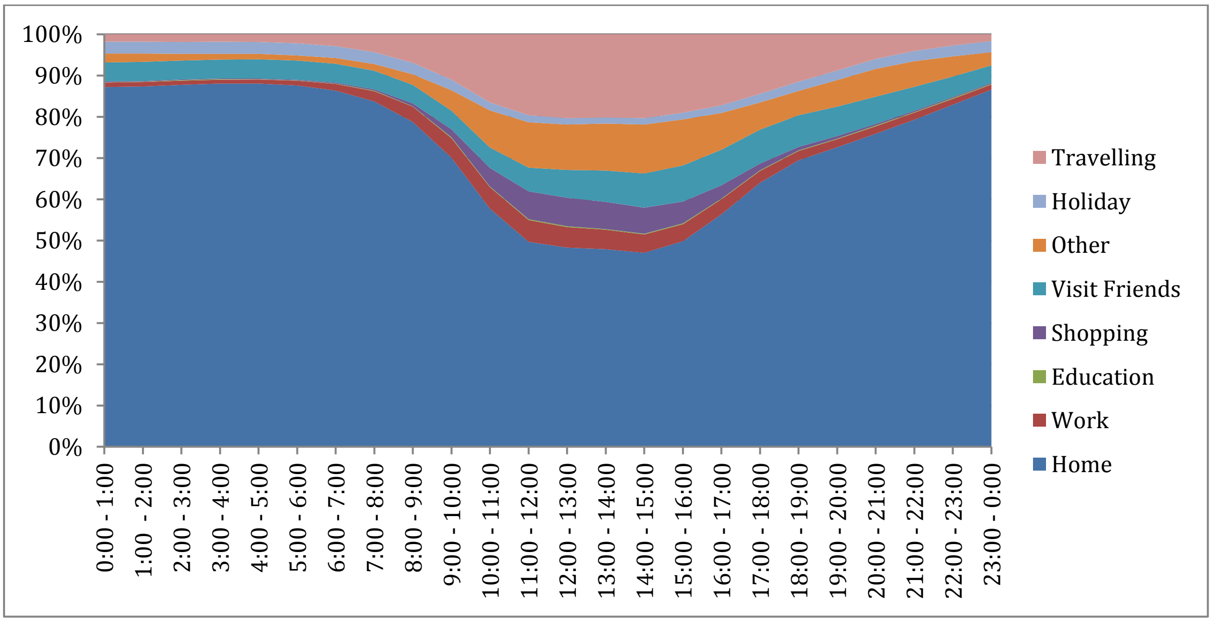


Figure 1.2: NTS participant location by time of day on weekend days (sample size: 150,100 people)

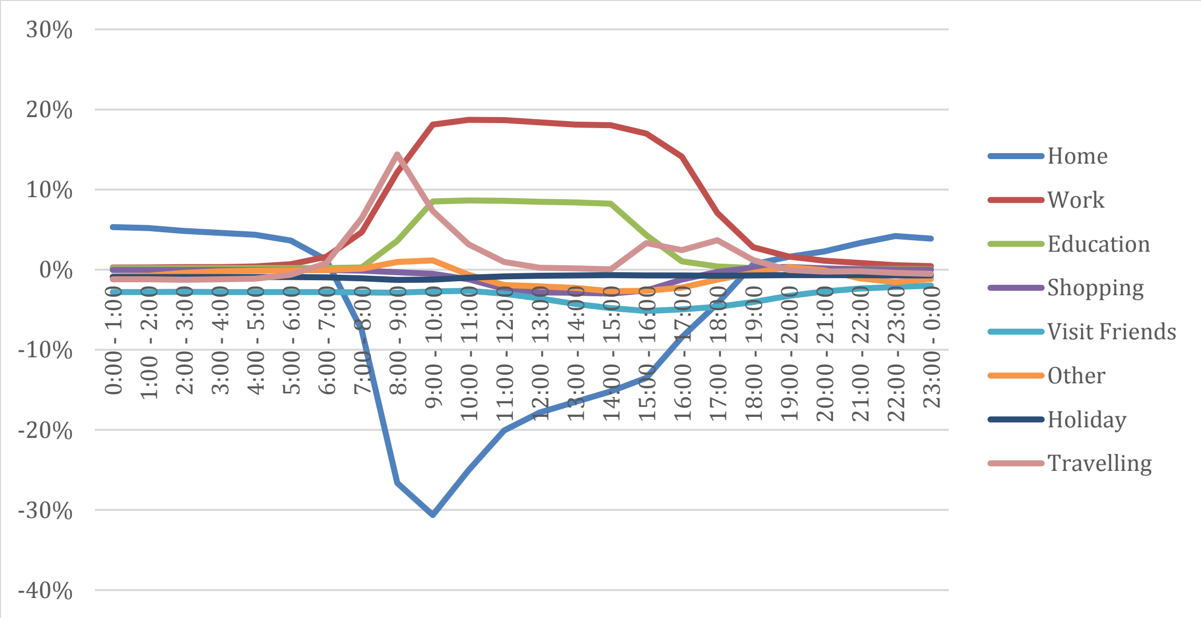


Figure 1.3: Difference between week and weekend days for NTS participant location by time of day (sample size: 150,100 people). Positive numbers represent more people at that location on a week day.

This analysis was completed for individual Government Office Regions. The difference between regions was small.

2 Home Occupancy

For each household in the survey the number of people identified as at home during each hour was counted. This allowed the occupancy level of each house to be calculated. Results are presented in figures 2.1 and 2.2

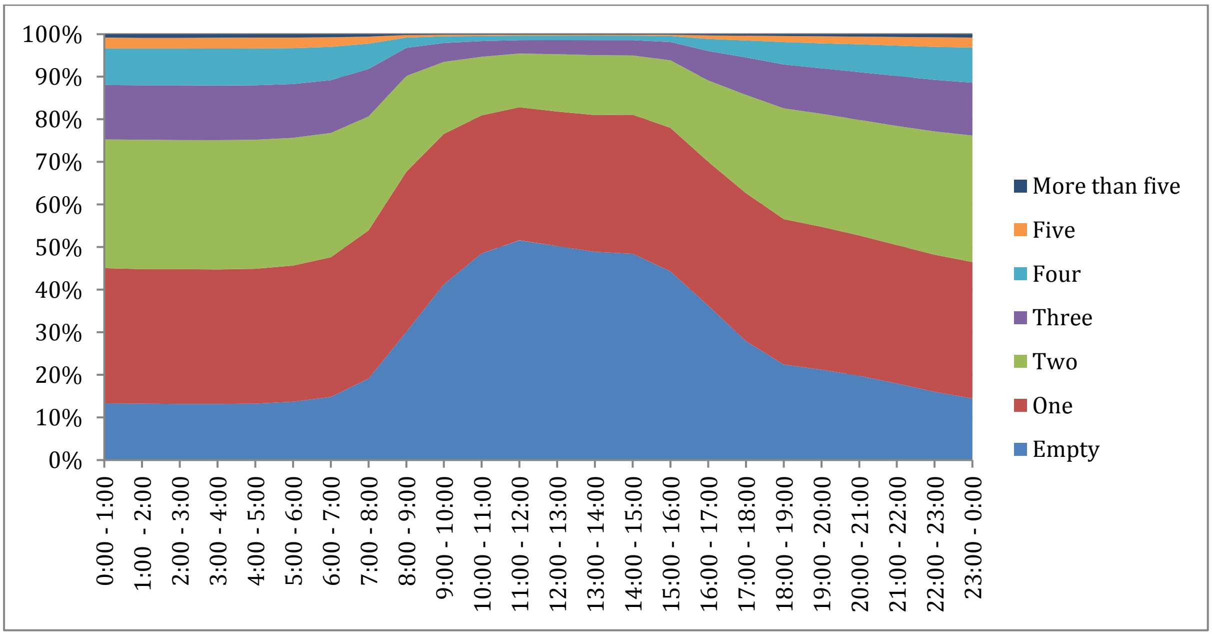


Figure 2.1: Number of people at home by time of day on week days (sample size: 64,495 households)

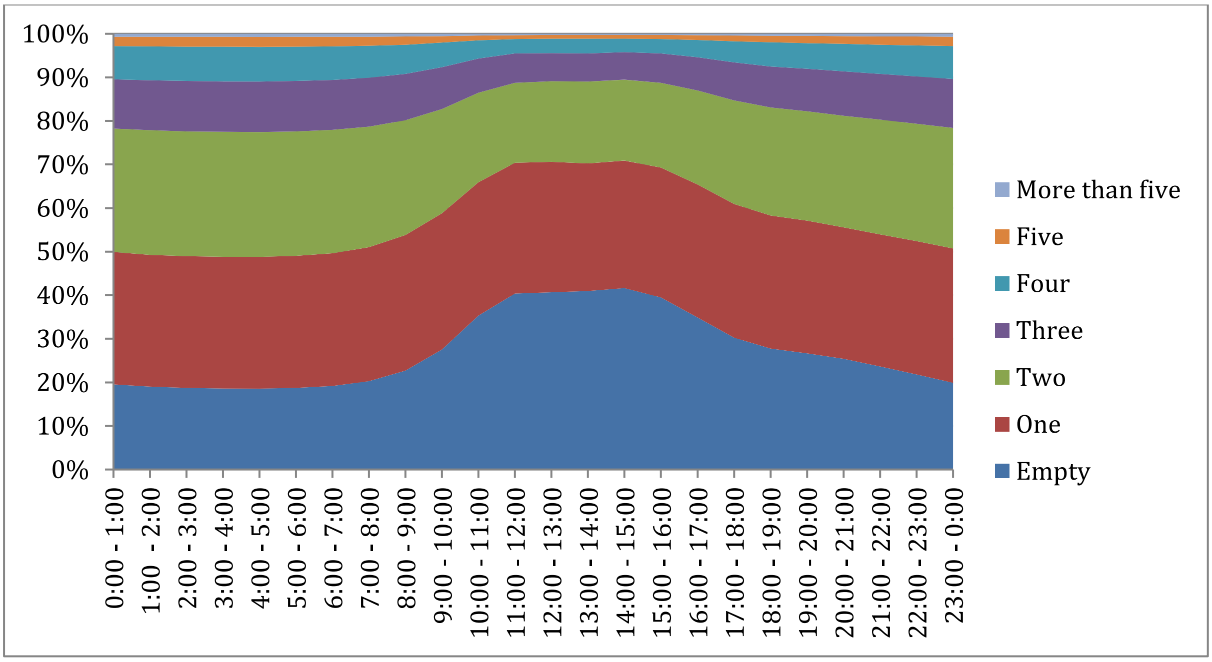


Figure 2.2: Number of people at home by time of day on weekend days (sample size: 64,495 households)

Of relevance to both heat demand and HEMS design are the observations that:

1) More houses are empty overnight at weekends (nearly 20%) than on week days (around 13%).
2) Around 10% less houses are empty during the middle of the day at weekends than on week days.
3) People tend to be away from home around 1 hour earlier in the morning and1 hour later at night on week days.

It should be noted that this analysis does not identify how long any particular house is empty (see Section 4). It cannot be assumed that it is the same 13% of homes which are empty during the night on week days. People will be returning to some empty homes in the same hour as others are leaving different homes empty such that the overall level of empty homes remains constant.

2.1 Comparison to Time Use Survey

Due to the high level of homes shown empty overnight in the analysis of the National Travel Survey an alternative data set (The Time Use Survey) was used as a check. The Time Use Survey was conducted in 2000 and included around 5,000 households. Participants completed a diary for 2 days. From these diary entries it is possible to identify the times at which participants were at home. The results of this analysis are shown in figures 2.3 and 2.4. A discontinuity in the data occurs at 4:00. This is the time that the diary day started.

It can be seen that results from analysis of the Time Use Survey are remarkably similar to those from the National Travel Survey analysis. They show larger variability for two reasons:

1) A significantly smaller sample size
2) Smaller time windows in the Time Use Survey diary data.

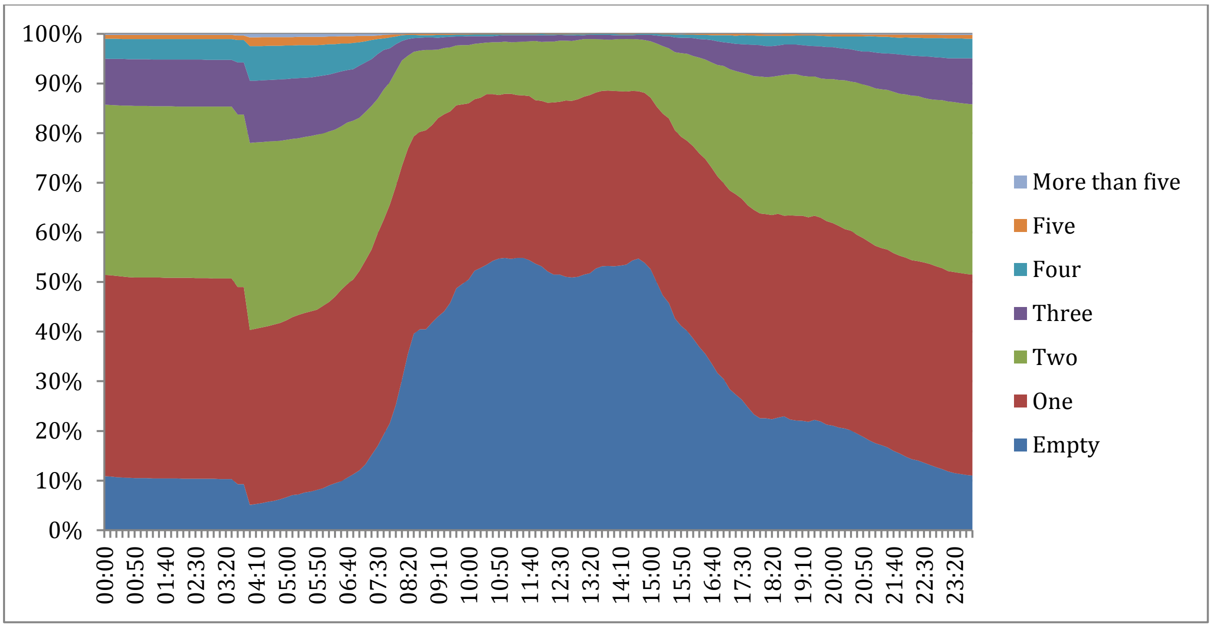


Figure 2.3: Number of people at home by time of day on week days from Time Use Survey (sample size: 4,980 households)

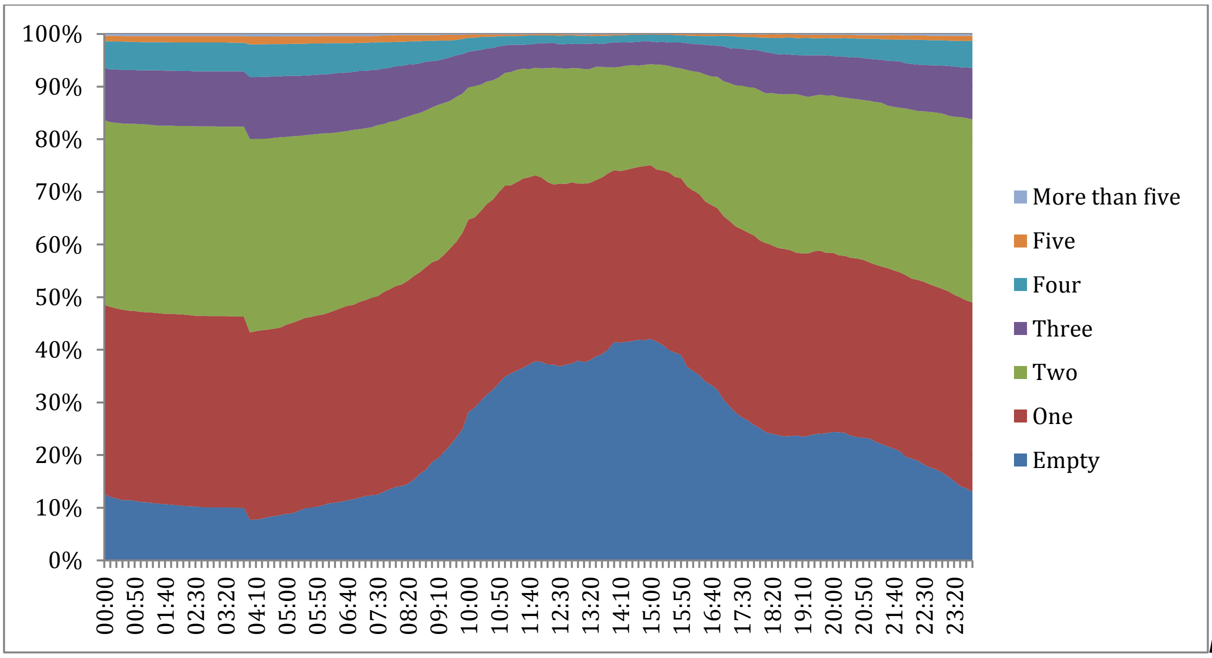


Figure 2.4: Number of people at home by time of day on weekend days from Time Use Survey (sample size: 4,973 households)

2.2 Seasonal Trends

The NTS occupancy analysis was sub-divided by season but showed little variation.

2.3 Regional Trends

A sub-division of the occupancy analysis by Government Office Region showed small differences with more properties in London being empty during week days with a peak of 54% empty compared to 52% nationally. This implies that the demand for heat within London will be slightly less in homes and slightly more in other locations compared to the rest of the UK. Differences between other regions were considered to be small enough that they would not have an influence on heat demand patterns.

2.4 Household Structure

Using household structure to sub-divided the NTS data shows that houses with a single occupant are more likely to be empty than those with multiple occupants. Large households are much more likely to have someone at home overnight.

Clear differences are seen between the occupancy of retired residents and those under 64 as shown in figures 2.5 to 2.8. Retired occupants are more likely to be recorded as away from home at night but less likely to be away during the day implying both a different heat demand profile and different heating control requirements.

The occupancy patterns of households with no children help to explain the high number of houses that are empty overnight. Comparison of figures 2.5 to 2.8 with figure 2.9 shows that households with children show higher occupancy overnight. With the increase in single person households it is likely that there will be an increase in the number of houses which are empty overnight.

It is possible that energy savings are achievable for houses which are left empty overnight by reducing heating demand when these houses are empty if these occasions can be correctly identified or residents can be given an easy way of turning off their heating on these occasions.

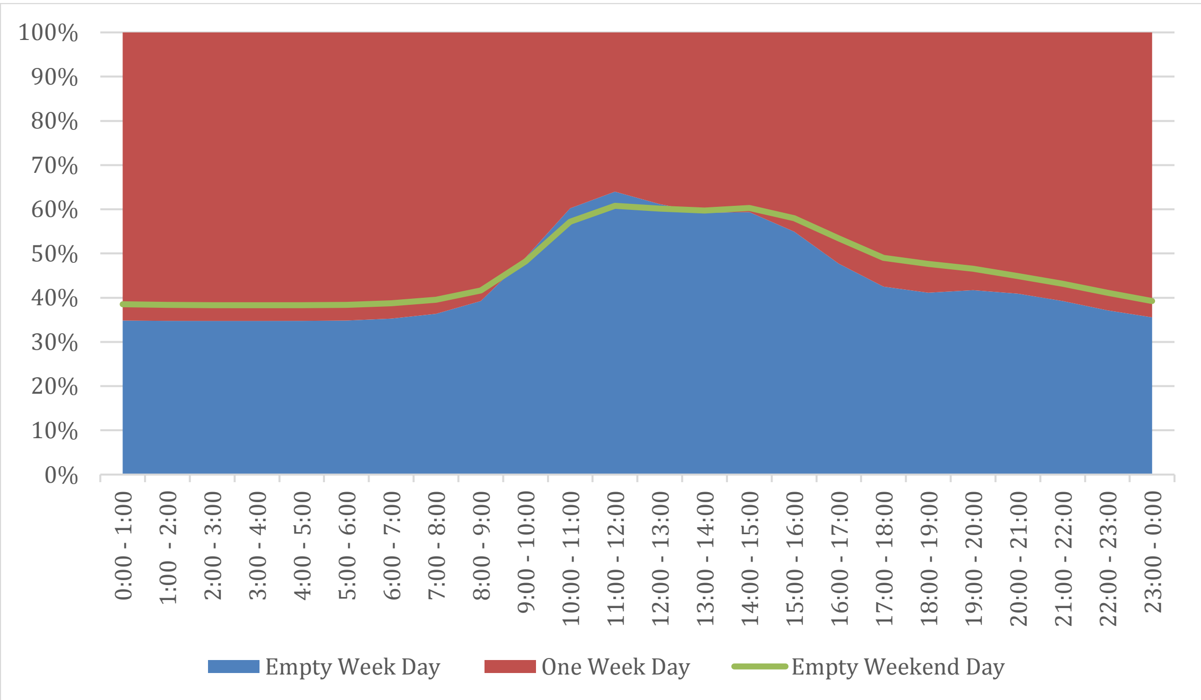


Figure 2.5: Single adult aged 65+ occupancy patterns (sample size: 8,273 households).

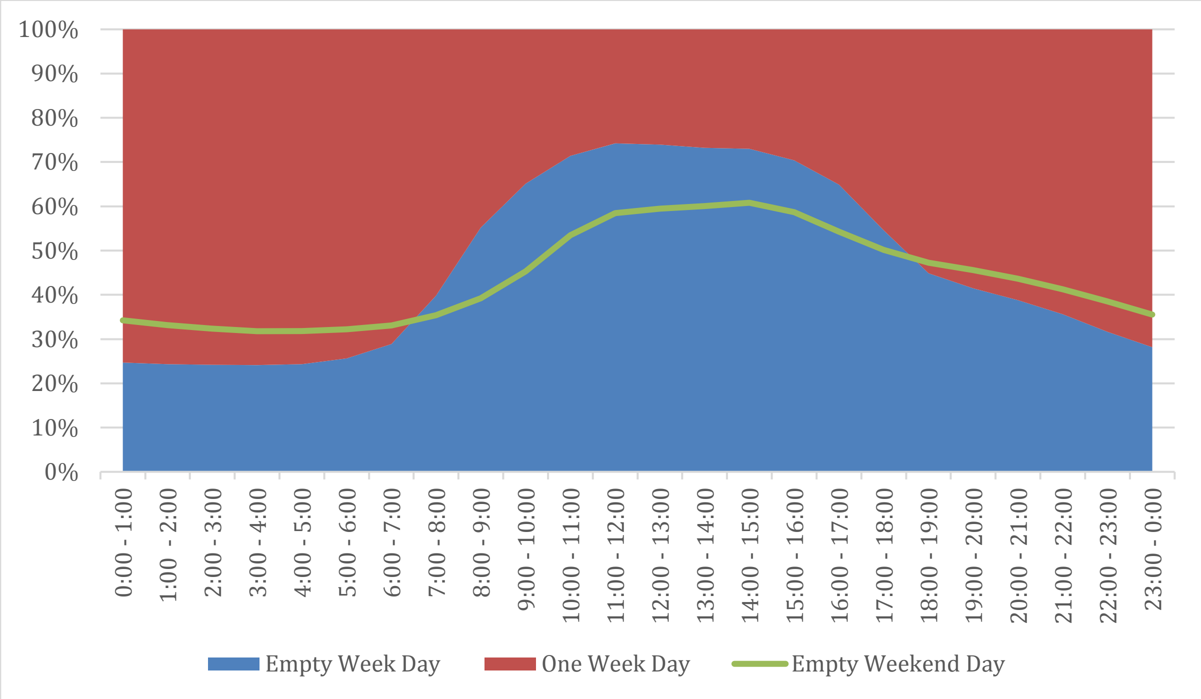


Figure 2.6: Single adult aged 16-64 occupancy patterns (sample size: 9,283 households).

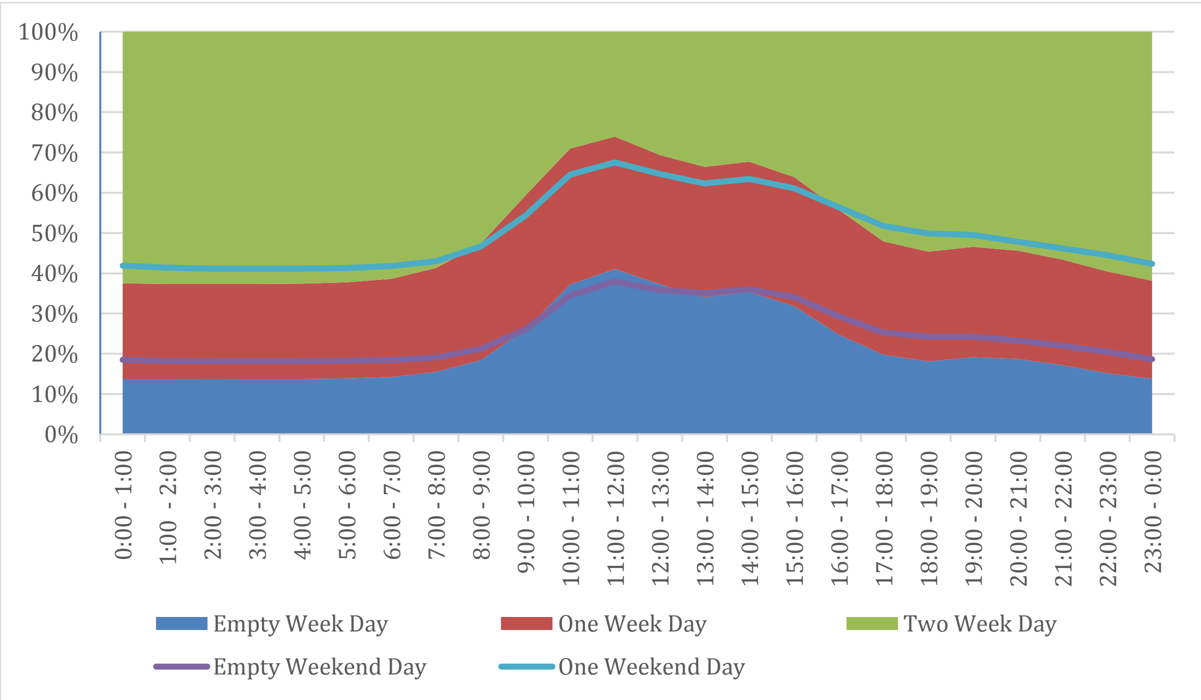


Figure 2.7: Occupancy patterns of households of two adults aged 65+ (sample size: 8,516 households).

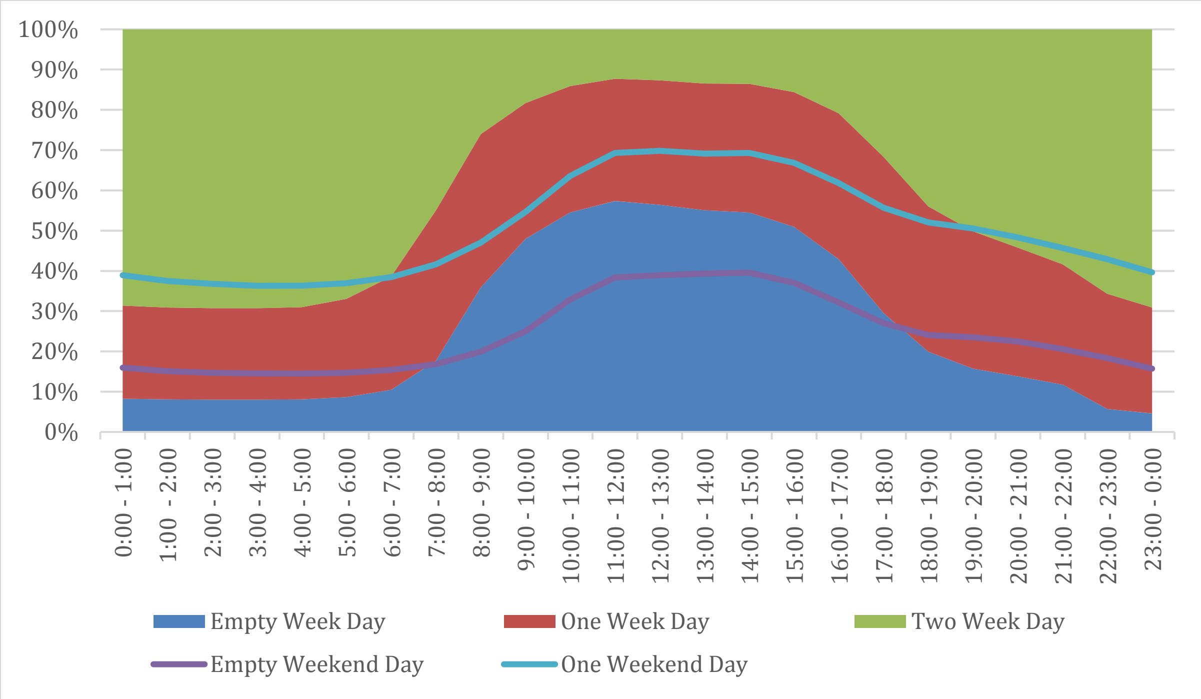


Figure 2.8: Occupancy patterns of households of two adults aged 16-64 (sample size: 14,152 households).

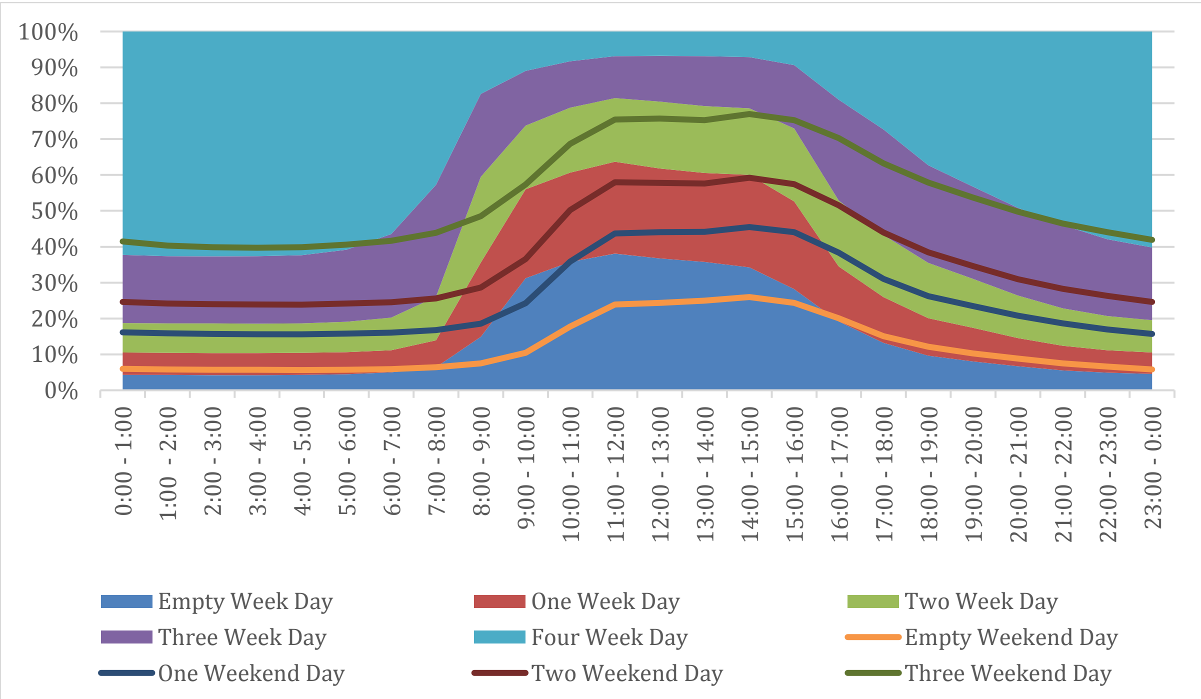


Figure 2.9: Occupancy patterns of households of 2 adults and 2 children (sample size: 5215 households).

2.5 Age

The occupancy data was sub-divided by resident age. Since the residents of a house can be any age the analysis was completed using the age of the person whose data was processed first for that house.

Residents over the age of 60 are more likely to be at home during the day. Their houses are also more likely to be empty overnight and at weekends. In addition, they are more likely to be away from home in the morning and return around lunch time rather than be out all day. Figures 2.10 and 2.11 compare households aged over 60 with those aged 20 to 39.

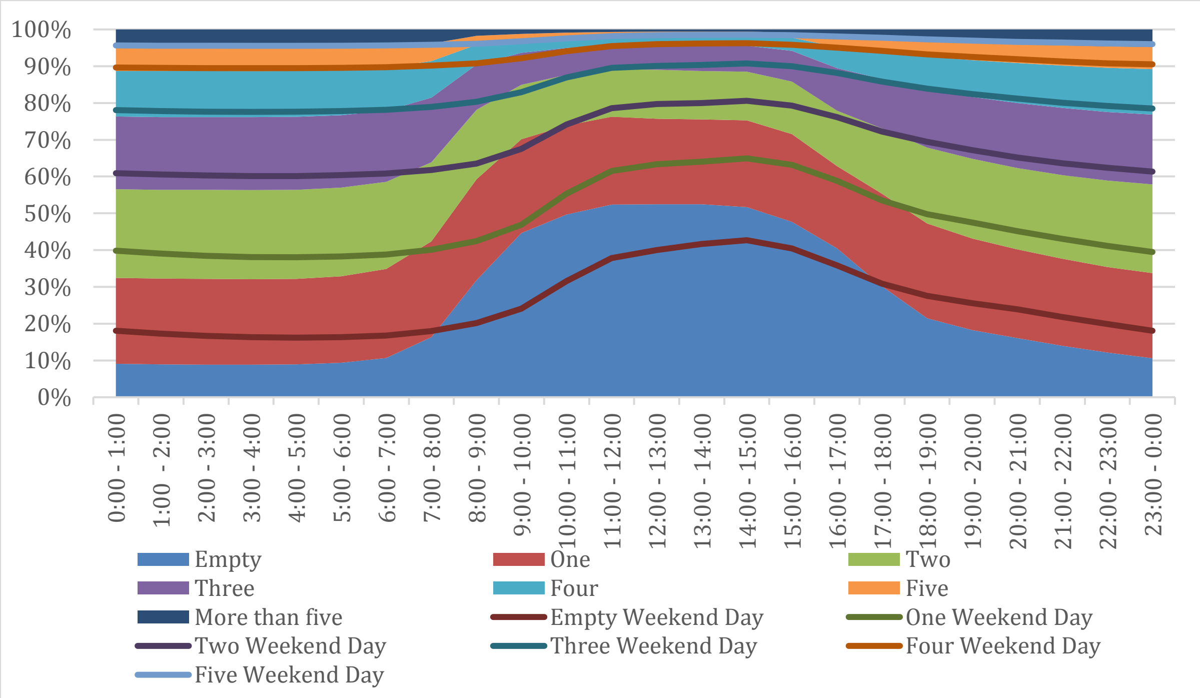


Figure 2.10: Occupancy patterns of households aged 20 – 39 (sample size: 17,054).

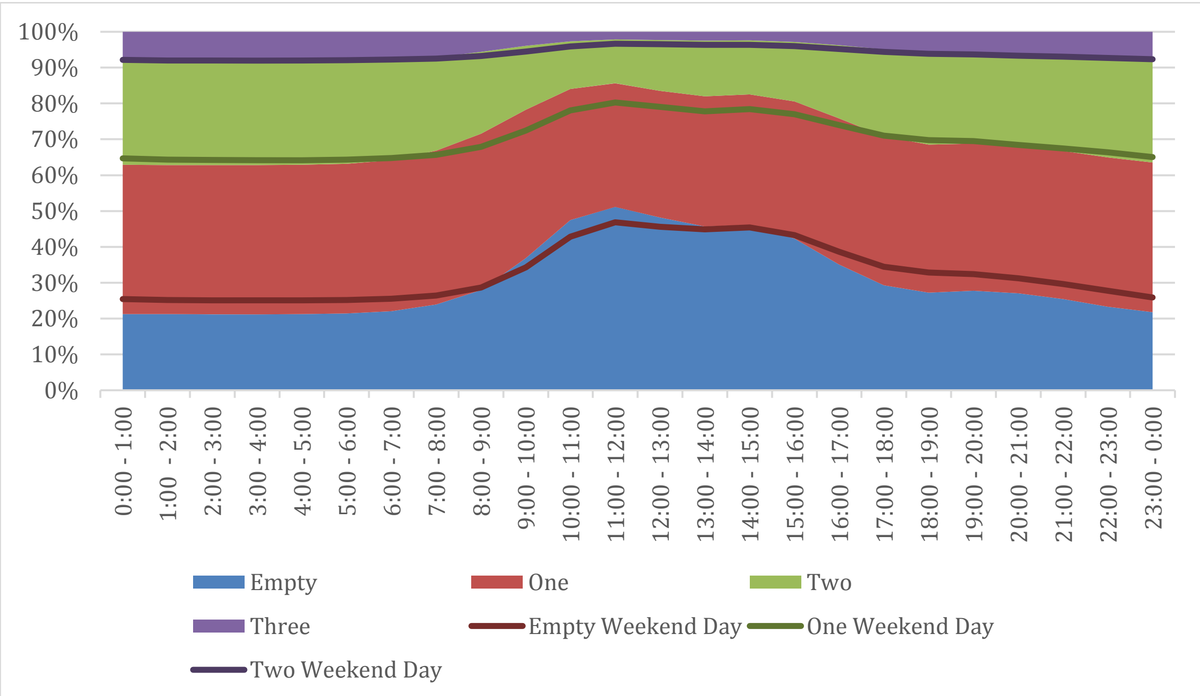


Figure 2.11: Occupancy patterns of households aged over 60 (sample size: 23,200).

2.6 Employment Status

Similar trends to the analysis of occupancy patterns by age are seen when the occupancy is sub-divided by employment status. Houses occupied by retired people are more likely to be empty at night and less likely to be empty during the day. Retired people are more likely to be out during the morning and return early in the afternoon whereas employed people are more likely to be out all day. Higher occupancy during the day combined with earlier return times imply a higher heat demand from houses with retired occupants. As for the analysis by age the employment status of the person whose data was processed first for a house was used to identify the employment status of the whole house.

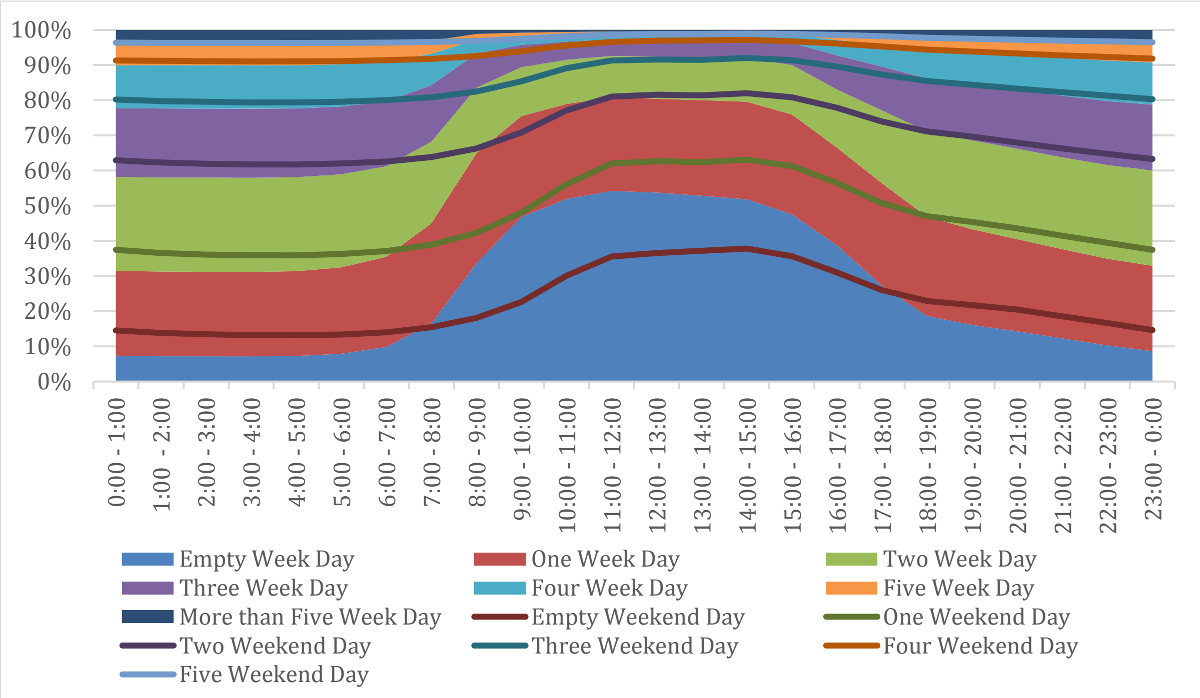


Figure 2.12: Occupancy patterns for employed households (sample size: 33,023 households)

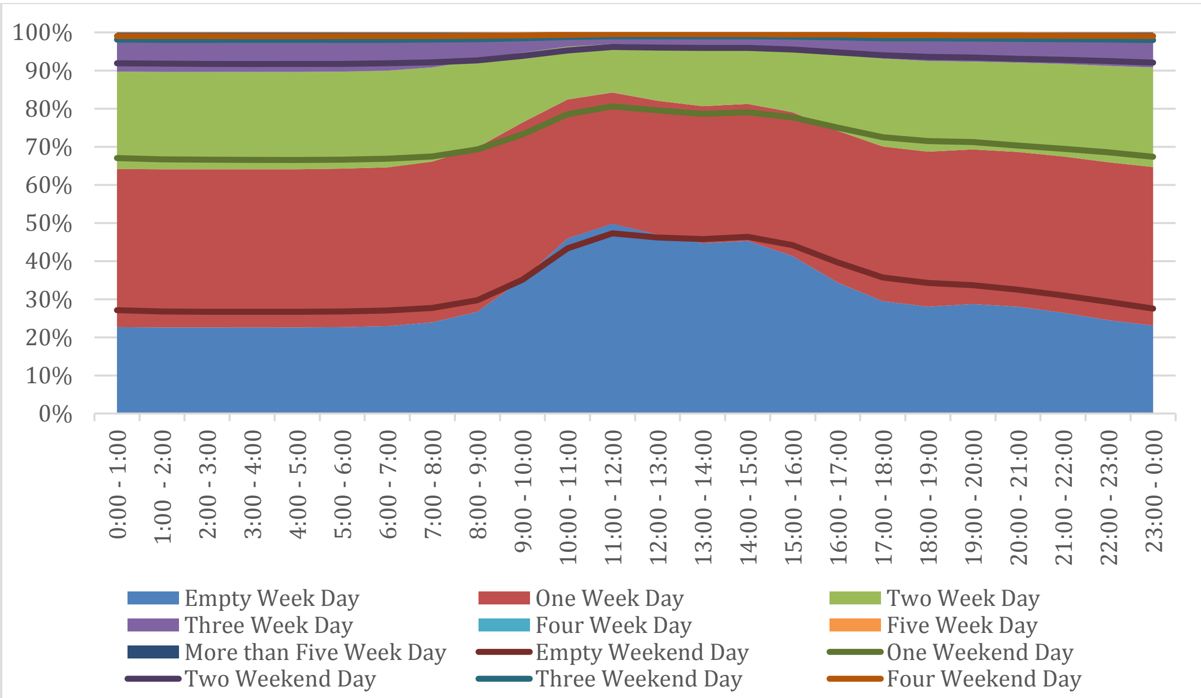


Figure 2.13: Occupancy patterns for retired households (sample size: 21,389 households).

2.7 Household Size

As household size increases it is more likely that someone will be at home both during the day and overnight. Figure 2.14 shows the proportion of homes that are empty at different times of day for different household sizes. Households with larger numbers of residents are less likely to have an opportunity to save energy by reducing temperature due to zero occupancy. Late morning is the time of day that houses are most likely to be empty.

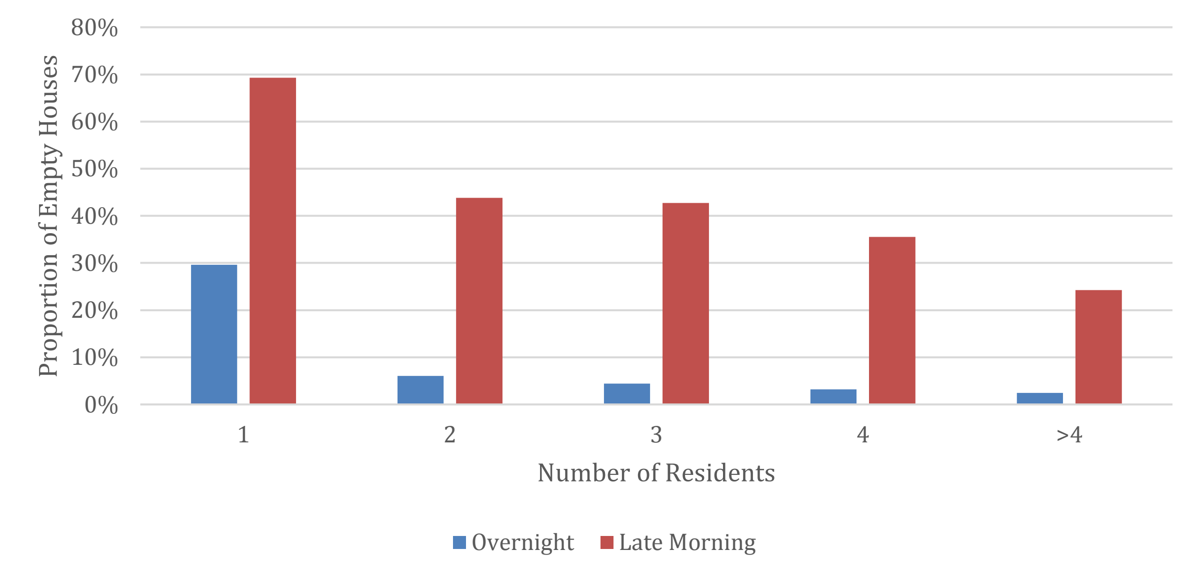


Figure 2.14: Proportion of empty houses at different times of day (sample size: 64,495 households).

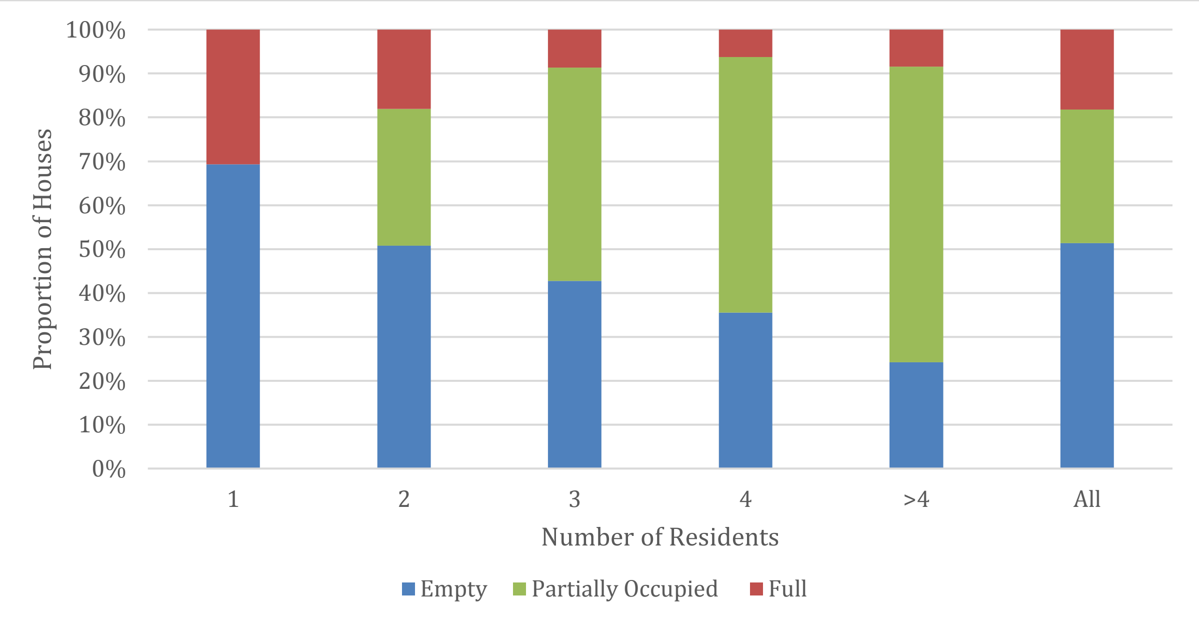


Figure 2.15: Occupancy between 11:00 and 12:00 for different household sizes (sample size: 64,495 households).

2.8 House Type

A breakdown of occupancy patterns by house type shows that flats are more likely to be empty than larger properties. This is consistent with their small family size. Terraced properties are also more likely to be empty than larger properties although the effect is less marked than for flats. This is due to the likelihood of terraced properties also housing smaller families than larger semi-detached and detached properties. The opportunities for energy saving during periods when a house is empty reduce as house size increases. Larger homes will have higher heat demands due to both their size and their occupancy patterns.

2.9 Area Type

An analysis of occupancy based on an urban to rural split shows that there is little difference. Houses in London have the highest likelihood of being empty and this decreases slightly through to rural properties which have the lowest likelihood.

3 Who is at home when?

An analysis was performed to identify the first person to return home to an empty house. The age and work status of these people was identified. Figures 3.1 and 3.2 show that older, retired people are more likely to return home earlier in the day during the week. There are two possible implications for both heat demand and HEMS control of this:

1) Homes of retired and older people are likely to be occupied for longer on week days.
2) The temperature required to achieve thermal comfort is likely to be higher for older people so the target temperature at the time of returning home should be higher for these groups.

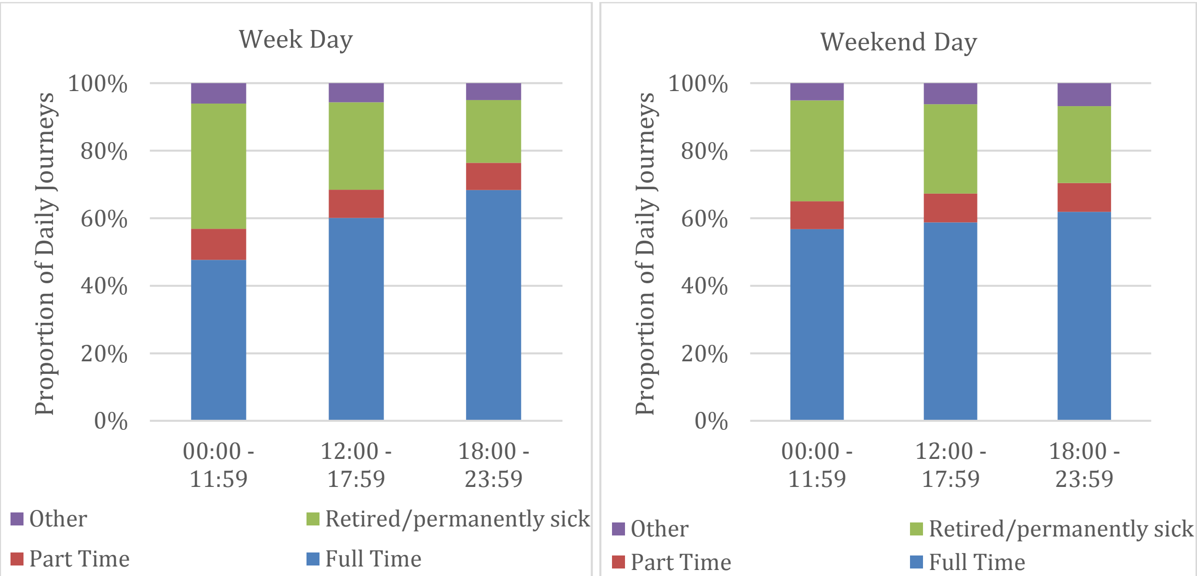


Figure 3.1: Work status of the first person home for week and weekend days at different times of day (sample size: 214,086 week day journeys 71,532 weekend journeys).

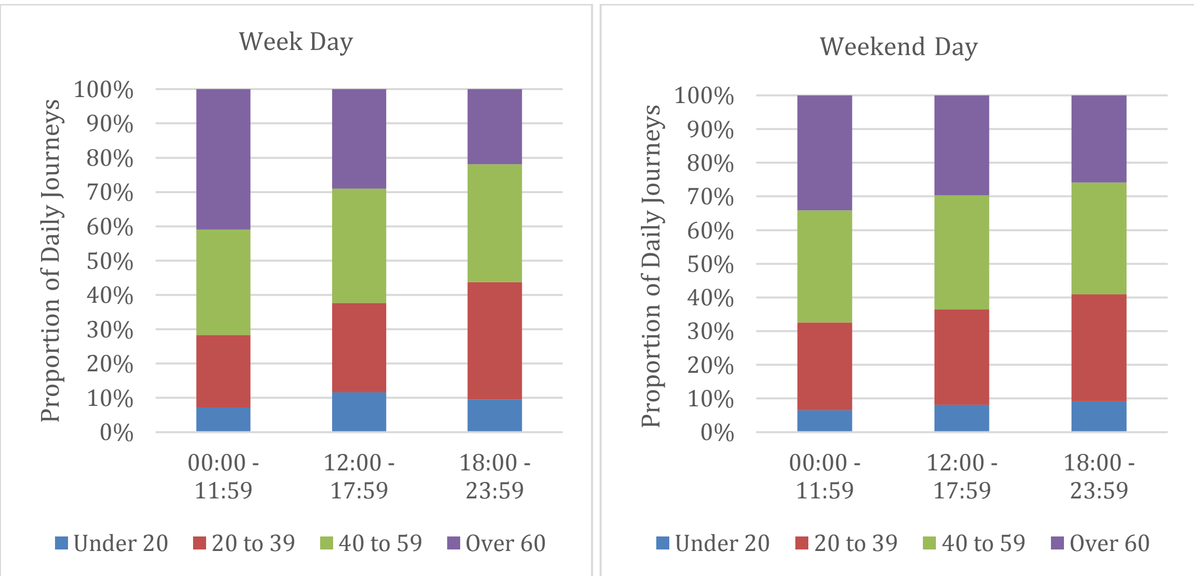


Figure 3.2: Age of the first person home for week and weekend days at different times of day (sample size: 214,086 week day journeys 71,532 weekend journeys).

4 Empty Homes

An analysis was conducted to understand more about the length of time that homes are empty and the number of times they are empty during the day. Both of these will influence the heating control strategy and the total energy demand.

4.1 Length of Time Empty

For individual homes the length of time that they were empty at different times of day was calculated as shown in Figure 4.1. The most popular length of time for a house to be empty is 8 hours. These houses are typically empty in a window between 7:00 and 17:00. Few homes are empty for more than 12 hours a day unless they are empty for 24 hours or more. Around 10% of homes were identified as empty for 24 hours or more.

From this figure if a house is empty at any particular time of day it is possible to identify the likelihood of it remaining empty for a particular number of hours. Each line on the graph shows the distribution of times for which houses are empty for a particular time of day. For example, if a house is empty between 14:00 and 14:59 then it is most likely that it will be empty for a total of 8 hours. This may be useful in developing HEMS control algorithms.

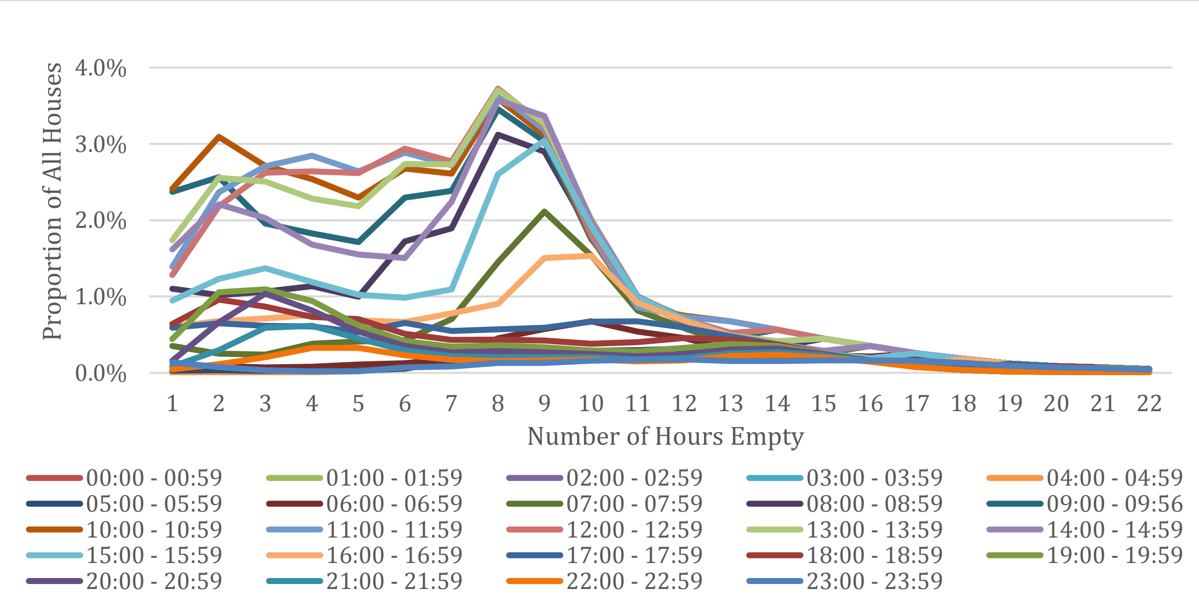


Figure 4.1: The number of houses empty for different lengths of time at different times of day (sample size: 64,495 households).

4.1.1 Length of Time Empty by House Type

Figures 4.2 to 4.5 show that different house types tend to be empty for different lengths of time. Smaller houses (flats and terraced) are, generally, empty for longer than larger houses.

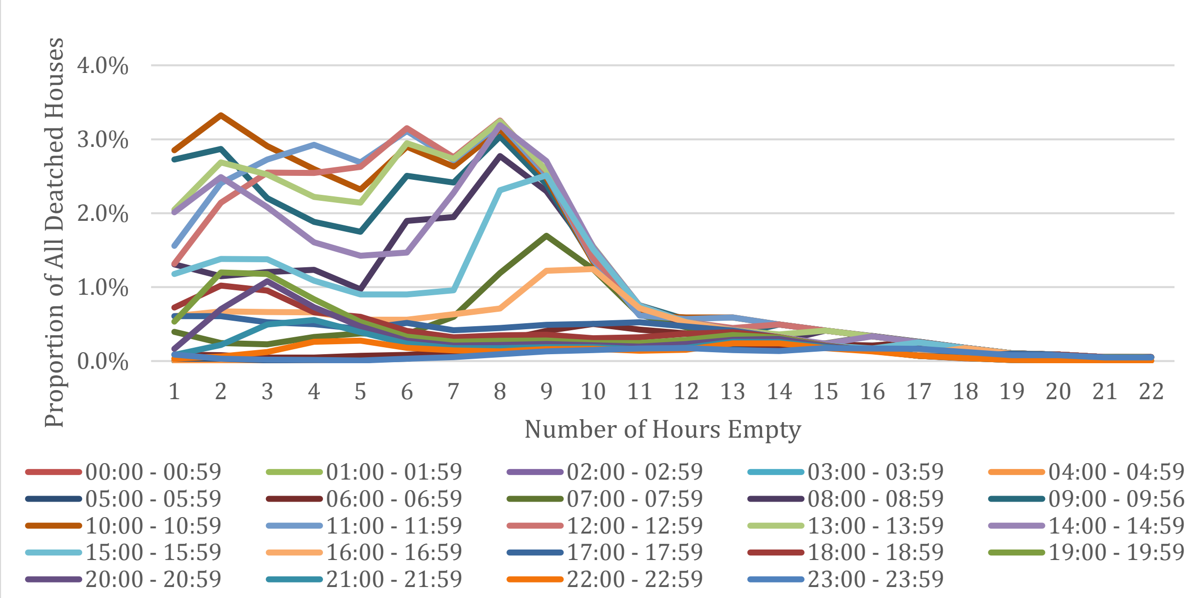


Figure 4.2: The proportion of detached houses empty for different lengths of time at different times of day (sample size: 15,924 households).

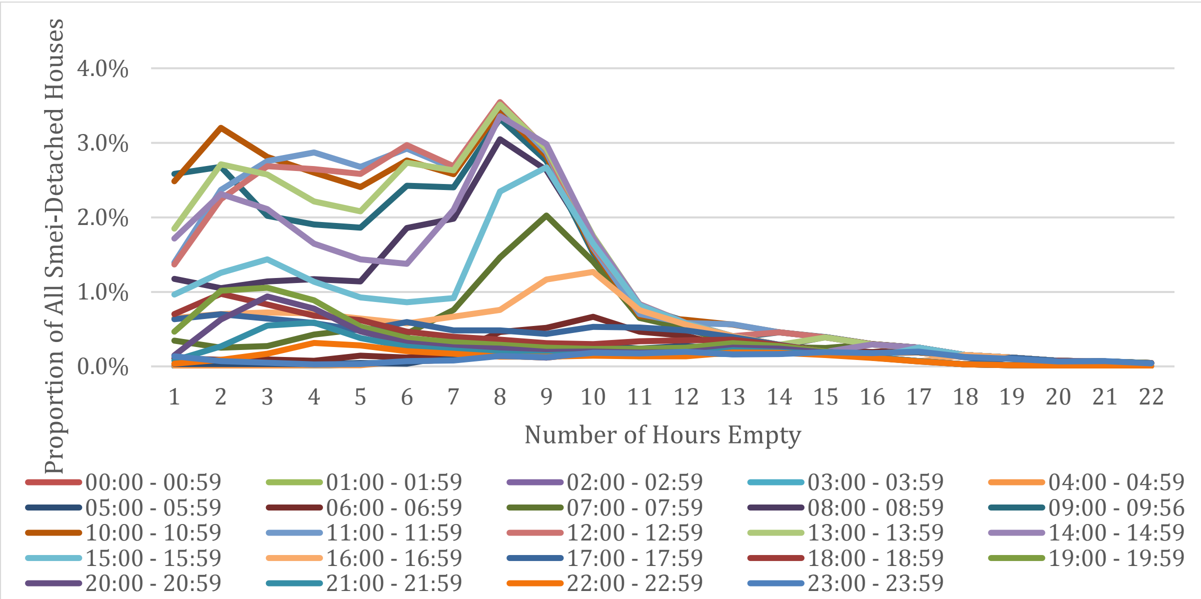


Figure 4.3: The proportion of semi-detached houses empty for different lengths of time at different times of day (sample size: 14,616 households).

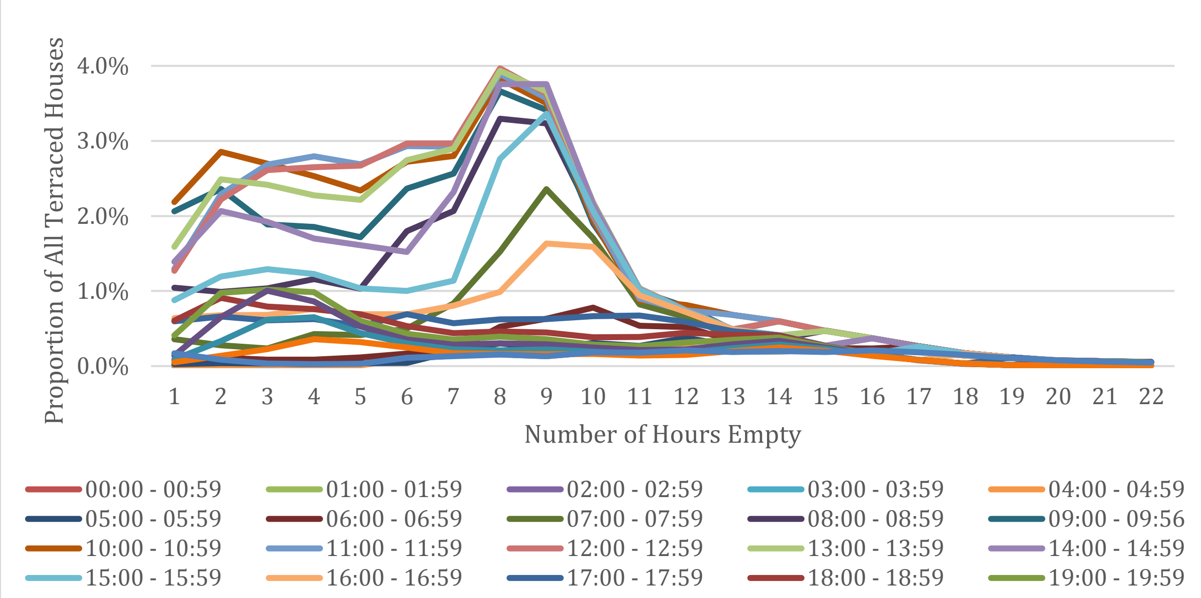


Figure 4.4: The proportion of terraced houses empty for different lengths of time at different times of day (sample size: 10,818 households).

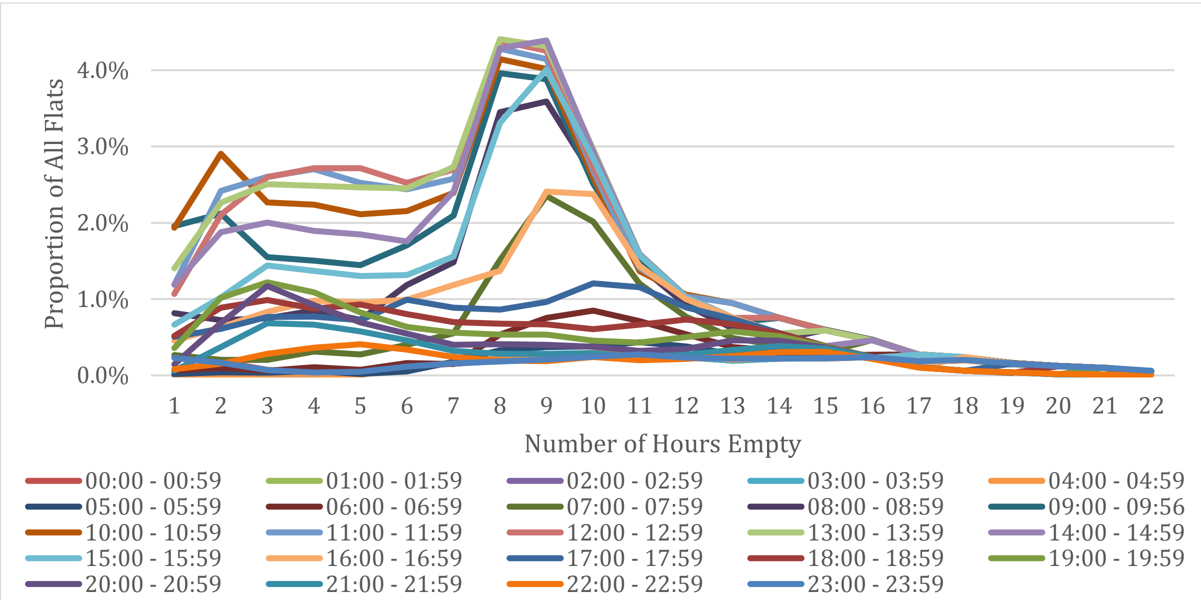


Figure 4.5: The proportion of flats empty for different lengths of time at different times of day (sample size: 7,522 households).

4.1.2 Length of Time Empty by Household Size

Figures 4.6 to 4.10 show that houses with lower numbers of residents tend to be empty for longer periods of time. For houses with 1 resident the most common length of time to be empty is 9 hours. For houses with 4 or more residents this reduces to 6 hours.

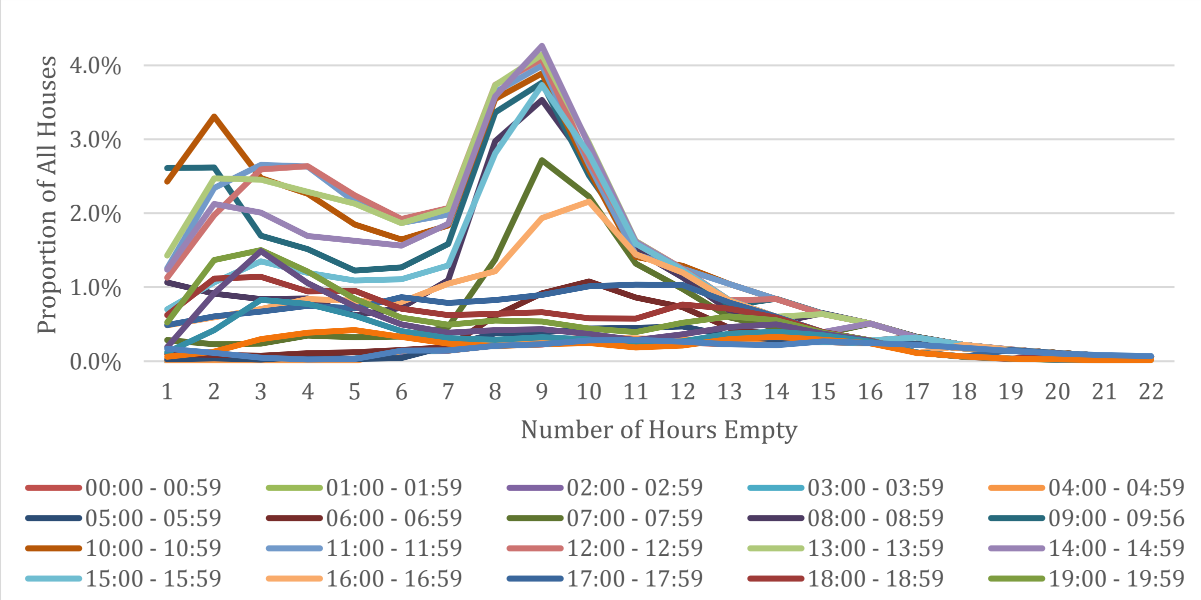


Figure 4.6: The proportion of homes with 1 resident empty for different lengths of time at different times of day (sample size: 13,416 households).

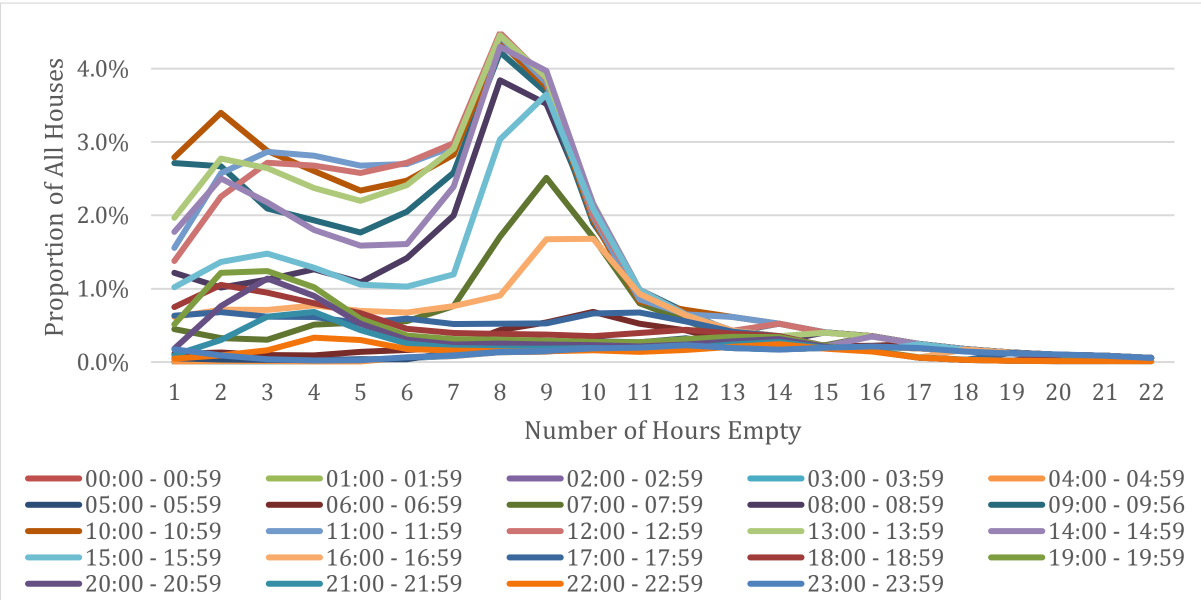


Figure 4.7: The proportion of homes with 2 residents empty for different lengths of time at different times of day (sample size: 16,995 households).

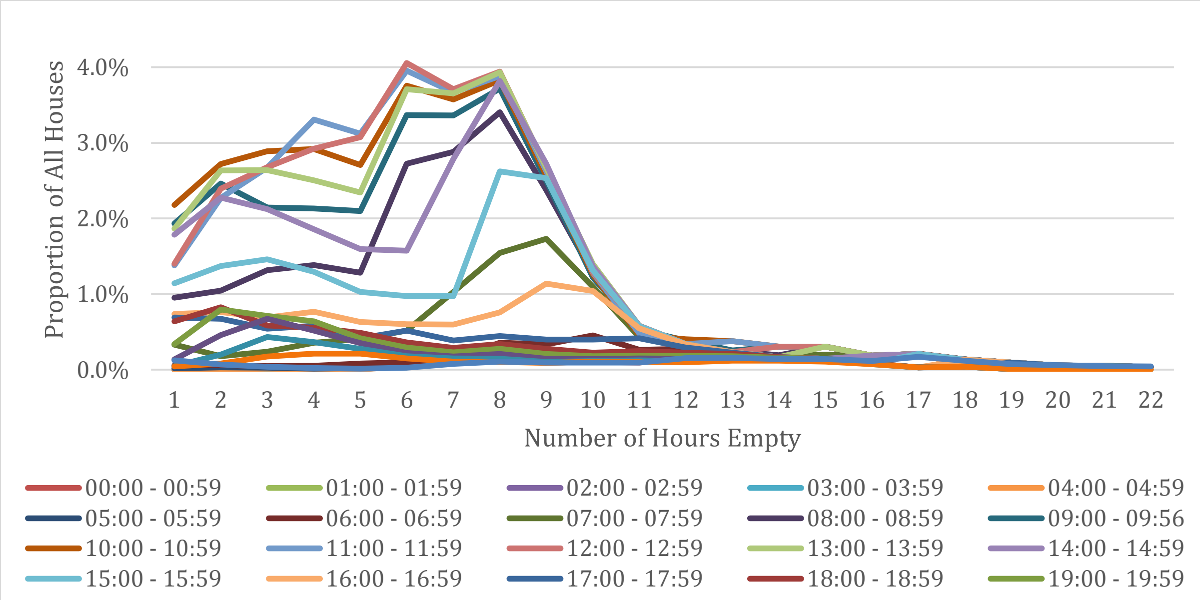


Figure 4.8: The proportion of homes with 3 residents empty for different lengths of time at different times of day (sample size: 6,783 households).

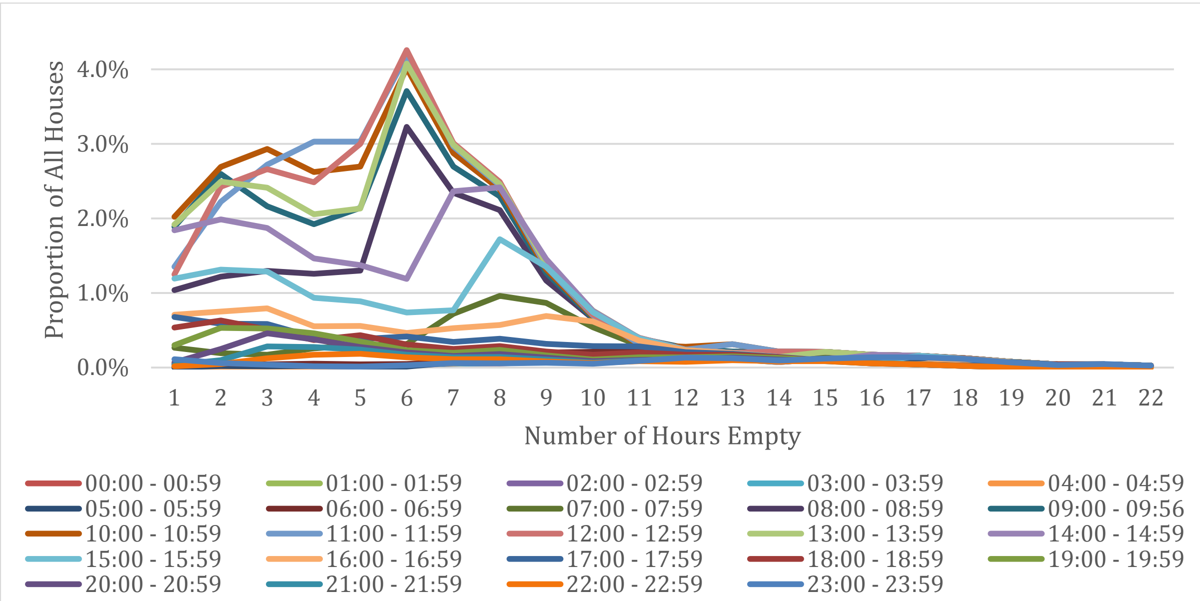


Figure 4.9: The proportion of homes with 4 residents empty for different lengths of time at different times of day (sample size: 6,048 households).

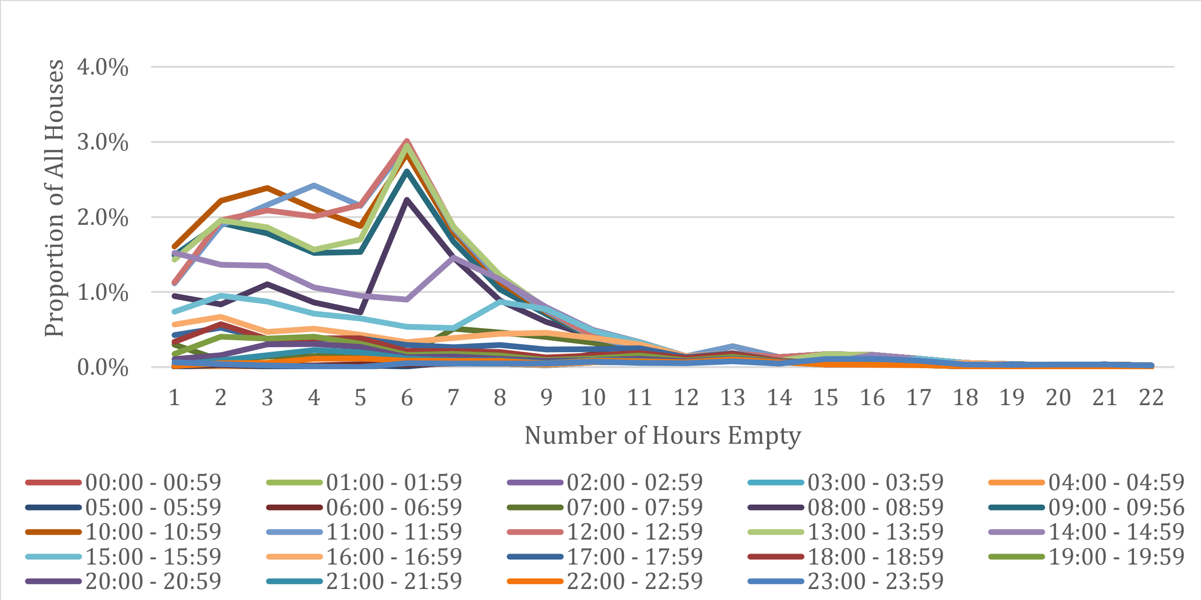


Figure 4.10: The proportion of homes with more than 4 residents empty for different lengths of time at different times of day (sample size: 2,826 households).

4.2 Number of Times Empty

The number of times each house was empty on each day of the week was calculated. Around 40% of houses have at least one person home throughout the day. Less than 15% of houses are empty more than once in a day. Houses are most likely to be empty at least once on a Sunday.

This analysis was broken down to show which types of houses and which resident demographics are most likely to be occupied or empty on different days (sections 4.2.1 to 4.2.4)

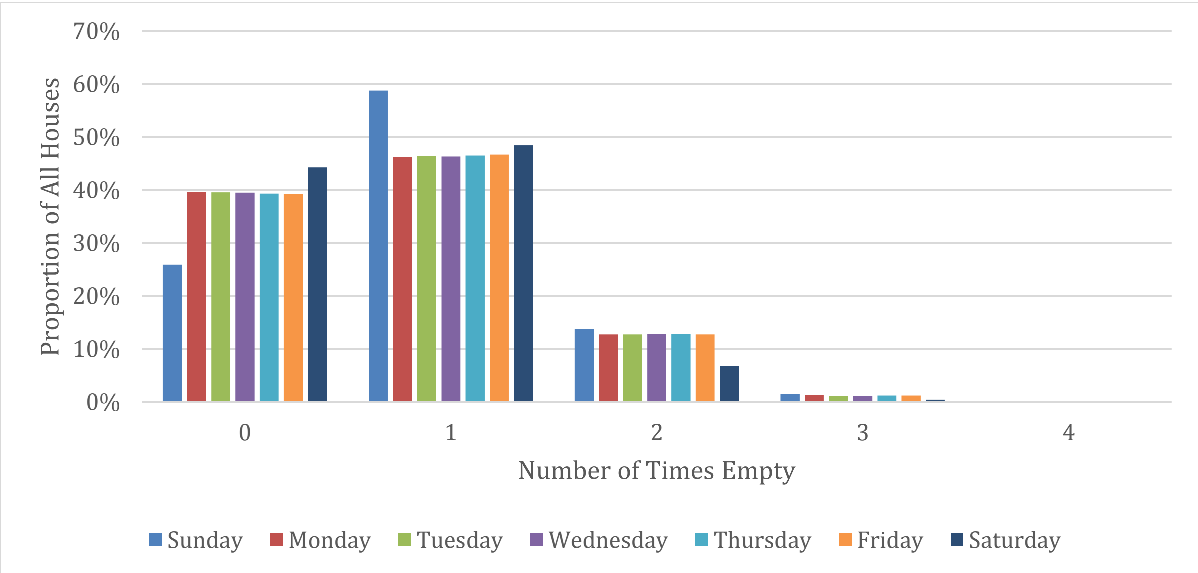


Figure 4.11: The number of times a day houses are empty on different days of the week (sample size: 64,495 households).

4.2.1 Number of Times Empty by House Type

Figure 4.12 shows the differences between house types in the number of times they are empty on different days. Flats are most likely to empty at least once on all days of the week with detached and semi-detached houses least likely to be empty. Note that behaviour is different on Saturdays when compared to Sundays.

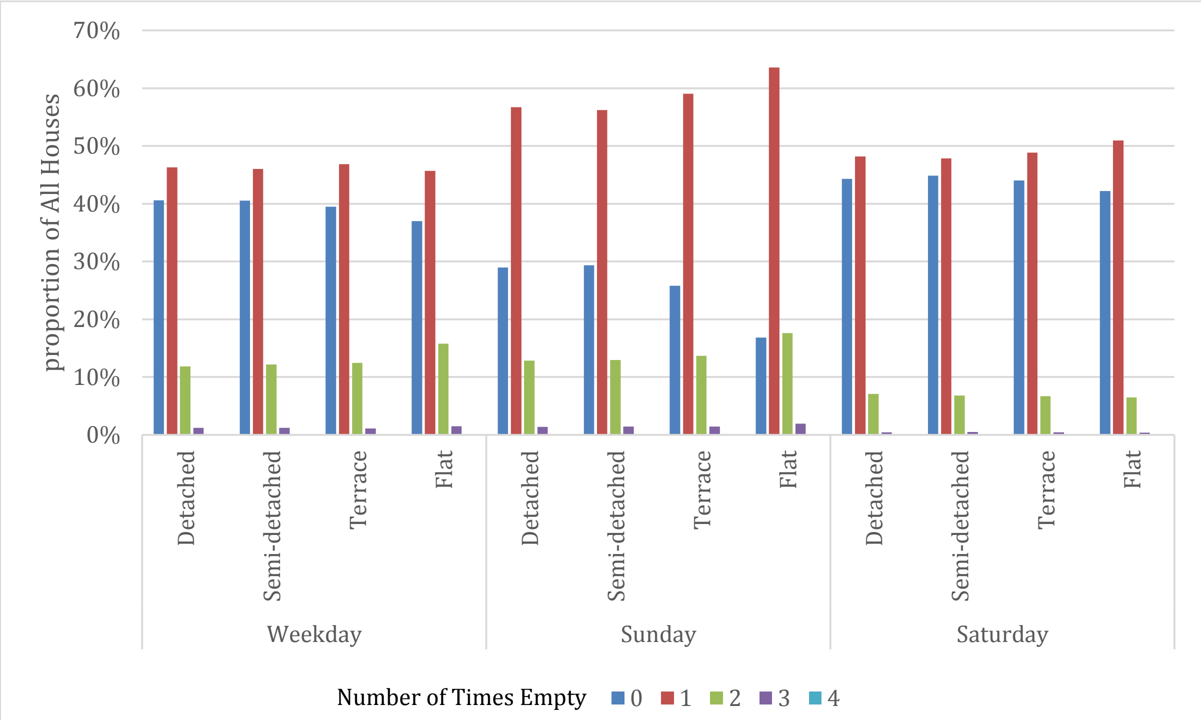


Figure 4.12: The number of times a day different house types are empty on different days of the week (sample size: 64,495 households).

4.2.2 Number of Times Empty by Household Size

Households with only one resident are more likely to be empty at least once at weekends than on a week day. As household size increases houses are less likely to be empty during the day, regardless of day of the week.

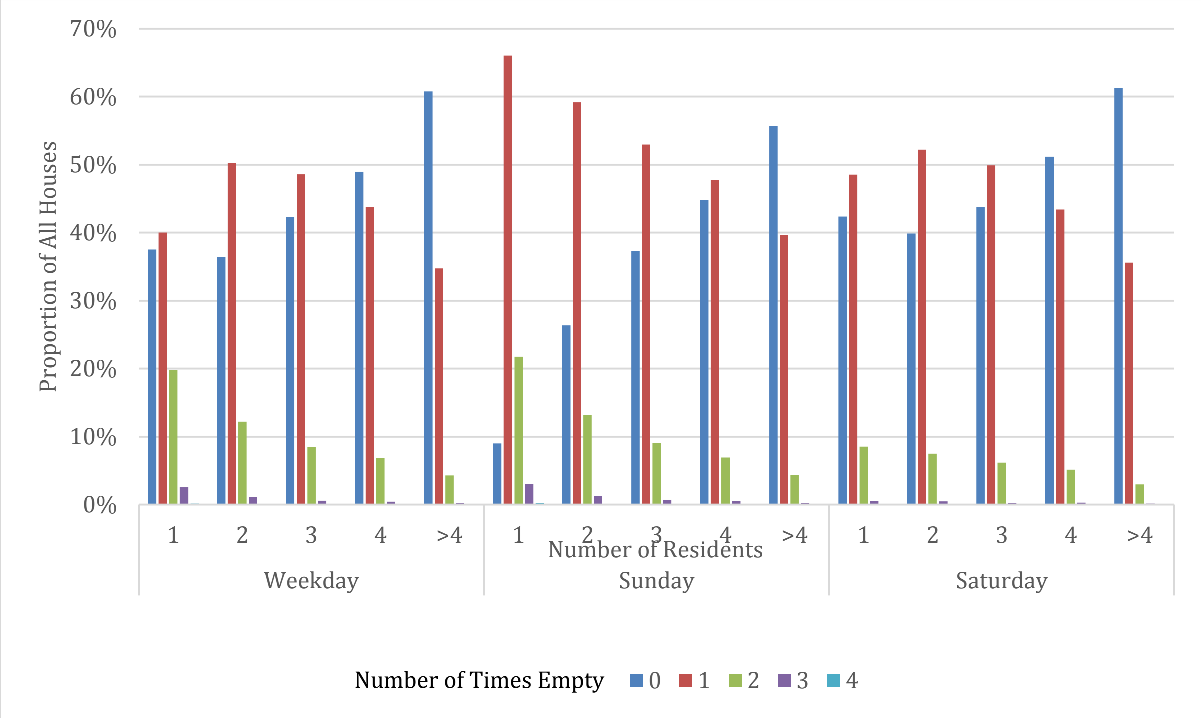


Figure 4.13: The number of times a day houses with different numbers of residents are empty on different days of the week (sample size: 64,495 households).

4.2.3 Number of Times Empty by Resident Age

Households with residents in the 20 to 39 age band are most likely to be empty on weekdays and Saturdays. The youngest age group (under 20) has the biggest changes in occupation from day to day. Houses with this age of resident are most likely to be occupied on a weekday, and are even more likely to be occupied on Saturday. They are, however, most likely to be empty at least once on a Sunday.

The age of the person whose data was processed first for a house was used to identify the age of the whole house.

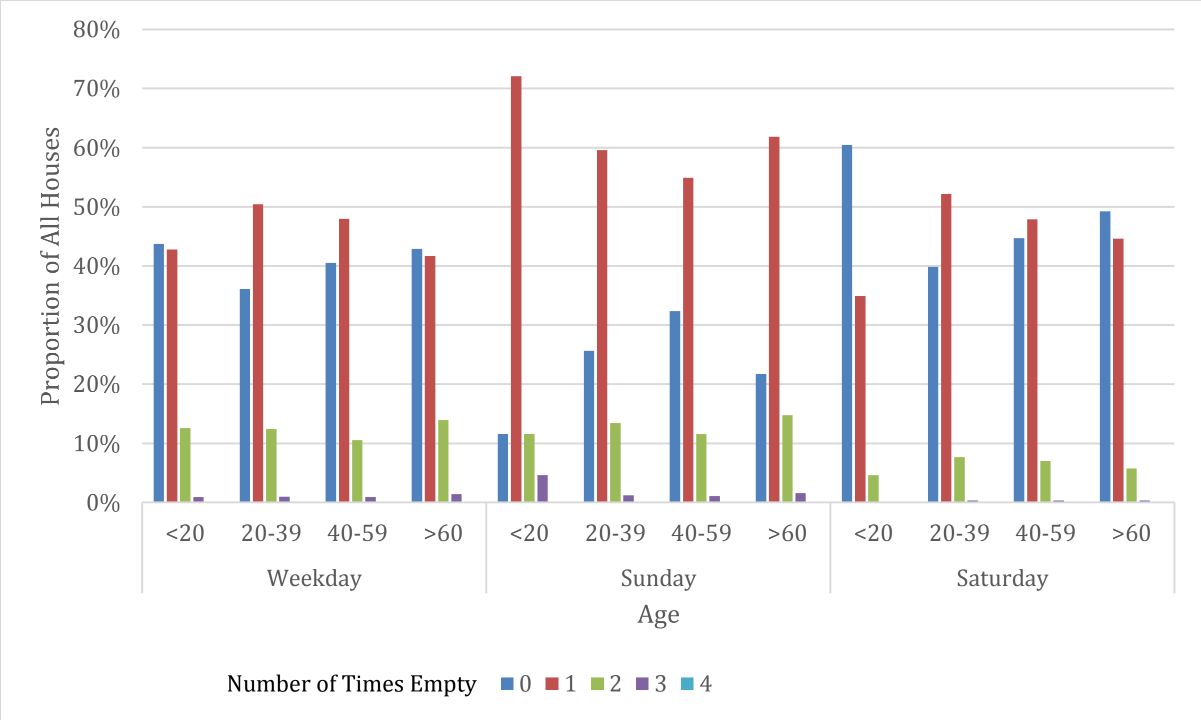


Figure 4.14: The number of times a day houses with different ages of residents are empty on different days of the week (sample size: 64,495 households).

4.2.4 Number of Times Empty by Resident Employment Status

Houses with residents that have full time jobs are most likely to be empty at least once on a week day. Houses with non-working residents are most likely to be occupied on a weekday.

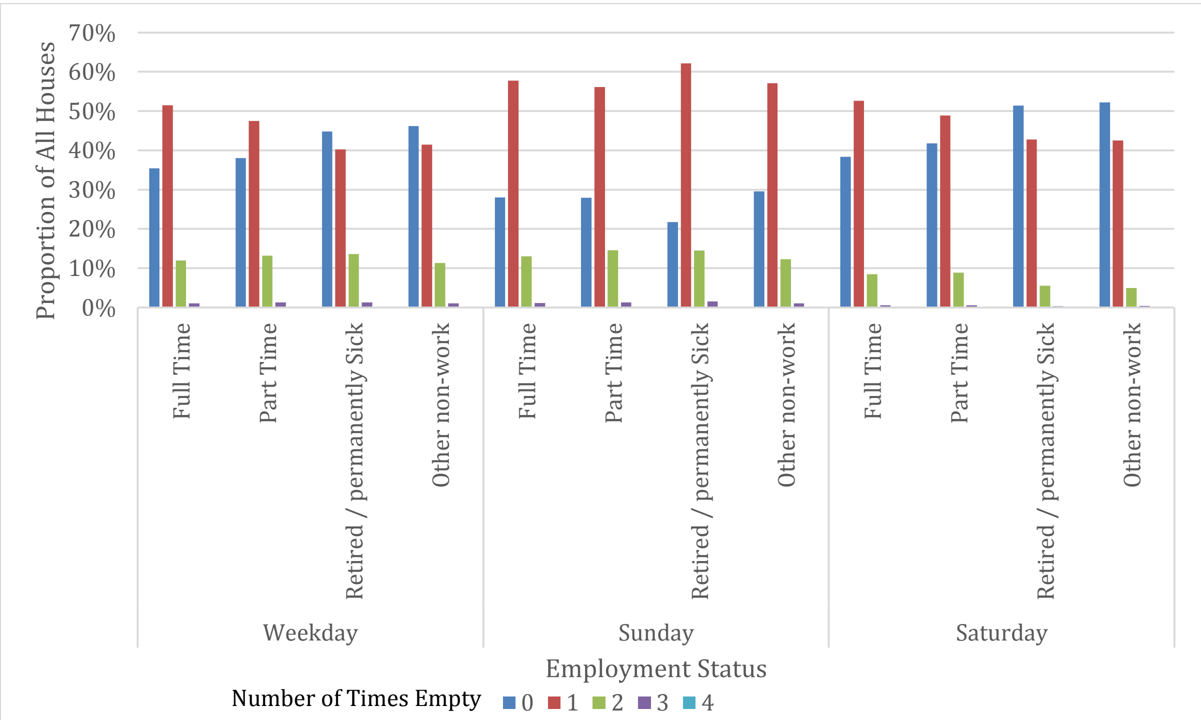


Figure 4.15: The number of times a day houses with different resident employment status are empty on different days of the week (sample size: 64,495 households).

The employment status of the person whose data was processed first for a house was used to identify the employment status of the whole house. This does not mean that every resident of a house identified as having residents in full time employment has a full time job. These houses may be occupied during the day by non-working residents, or residents that work from home.

5 Leaving Home and Returning Home

Various aspects of journeys to and from the home were analysed to establish how they might influence the demand for energy within the home.

5.1 Journey Time of Day

Figure 5.1 shows the times of day that people leave their home and return to it. These are closely related to the morning and evening peaks in energy demand. The peak time of arrival at home is 14:30 to 16:30 on week days. Few people arrive home between midnight and 9:00 am.

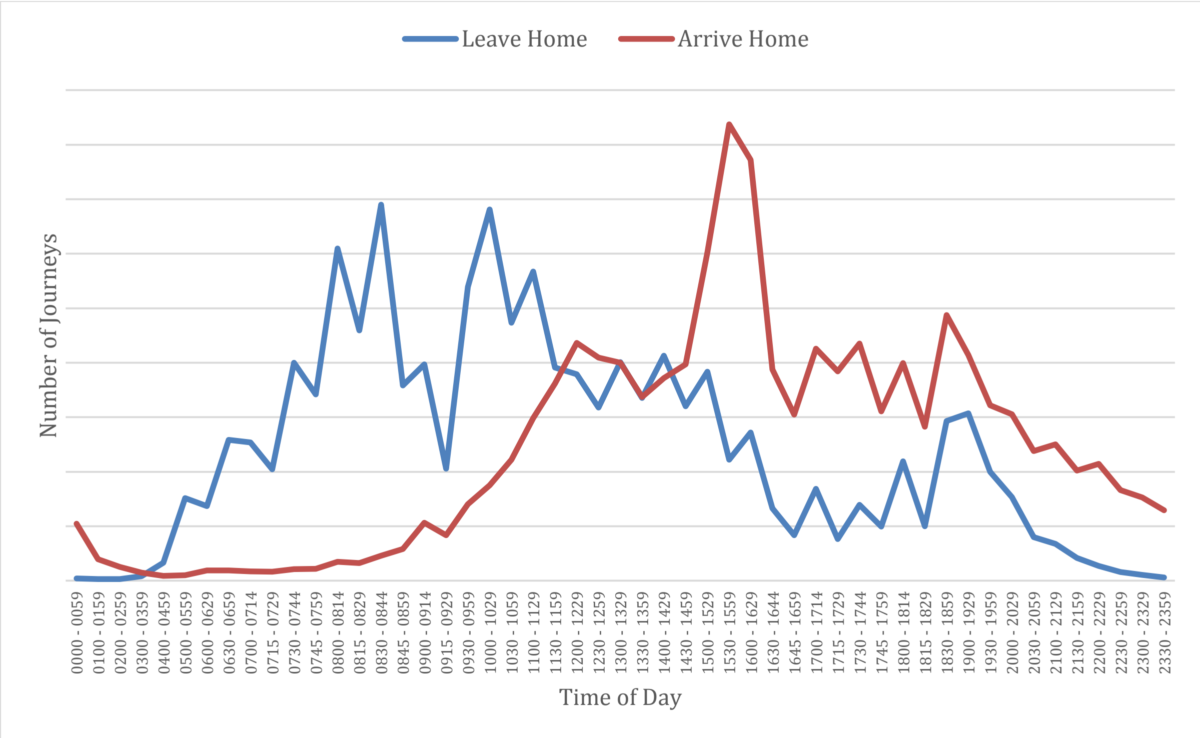


Figure 5.1 Times of arrival and departure from home (sample size: 1.25 million arrival journeys, 1.25 million departure journeys).

5.1.1 Arrival and Departure Time Variability

The standard deviation (in hours) of all arrival and departure times for each household in the survey was calculated. This is measure of the variability of arrival and departure times. Higher variability implies that simple timers will not be able to accurately match heating times with occupancy and that benefits from “intelligent” heat switching will be larger. Figure 5.2 shows the standard deviations of arrival and departure times for week days and weekend days.

Several points can be identified:

1) Variability in times of arrival and departure is larger on week days than on weekend days.
2) Return home times are more variable than home departure times.
3) During the week arrival and departure times are likely to vary by hours rather than minutes

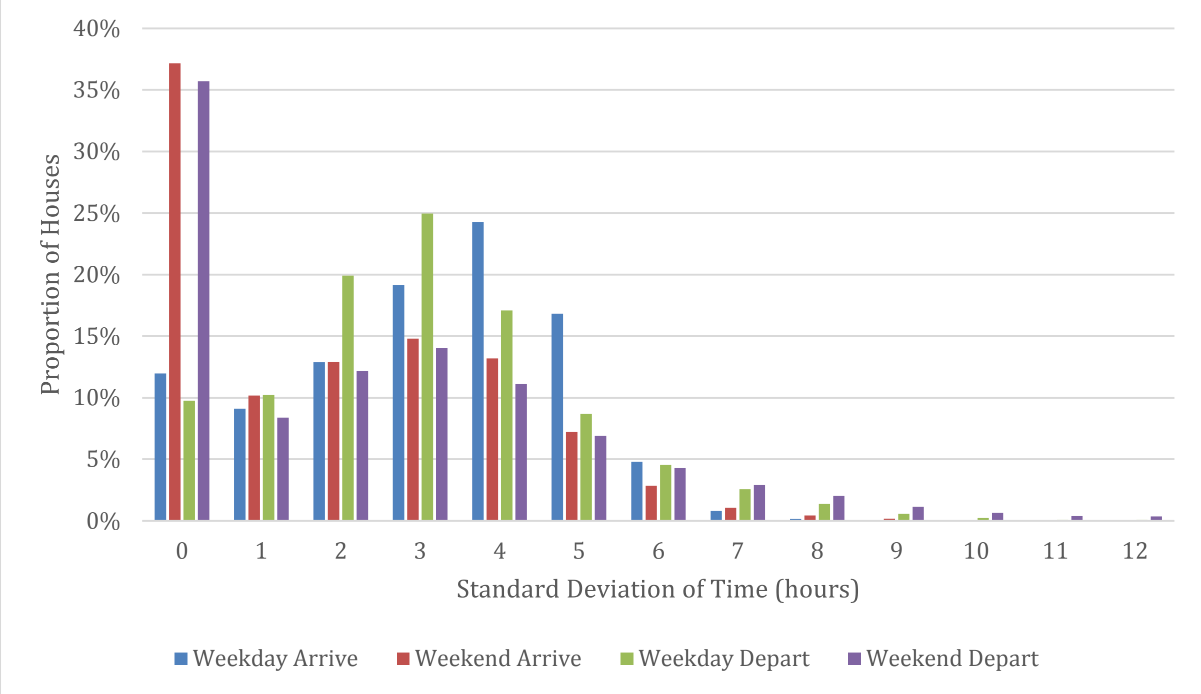


Figure 5.2: Variability of arrival and departure times for week days and weekend days (sample size: 64,495 households).

The variability of arrival and departure times was sub-divided by time of day. Figures 5.3 to 5.6 show that:

1) Week day morning arrival times show greater variability than afternoon arrival times
2) Week day evening arrival times are more predictable than morning and afternoon arrival times.
3) Week day morning departure times are the most predictable.
4) Week day afternoon departure times are the most variable.
5) At weekends the time of day does not influence variability of arrival and departure times as much as during the week.

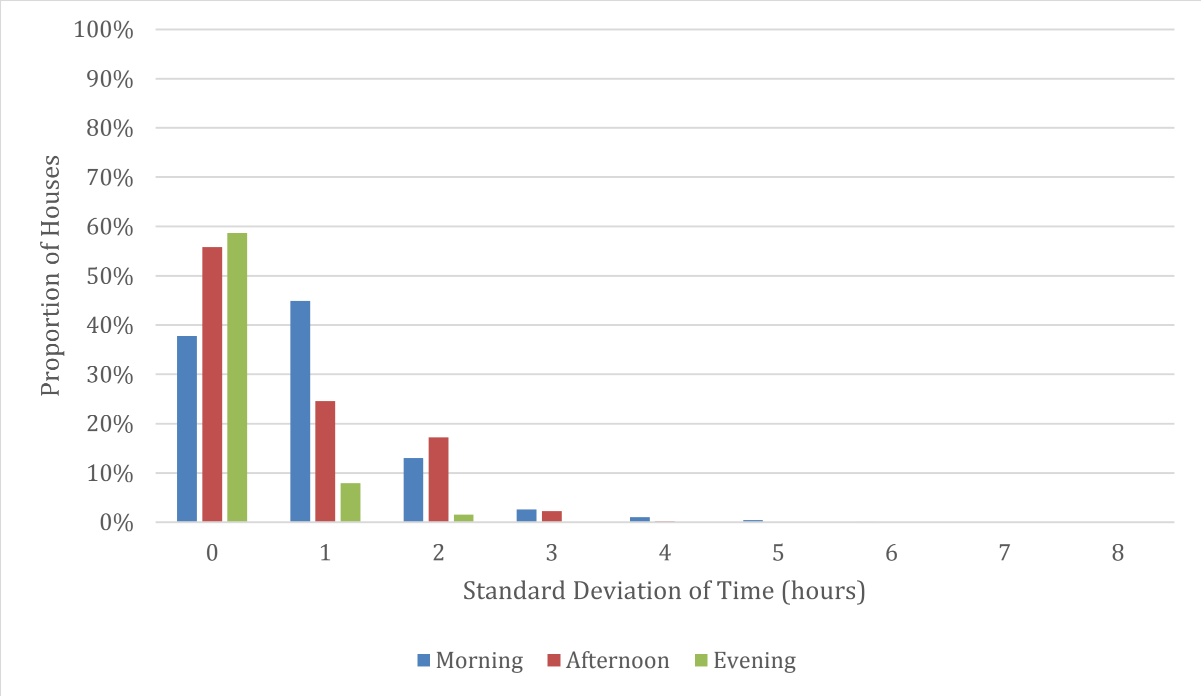


Figure 5.3: Variability of arrival times at different times of day for week days (sample size: 64,495 households).

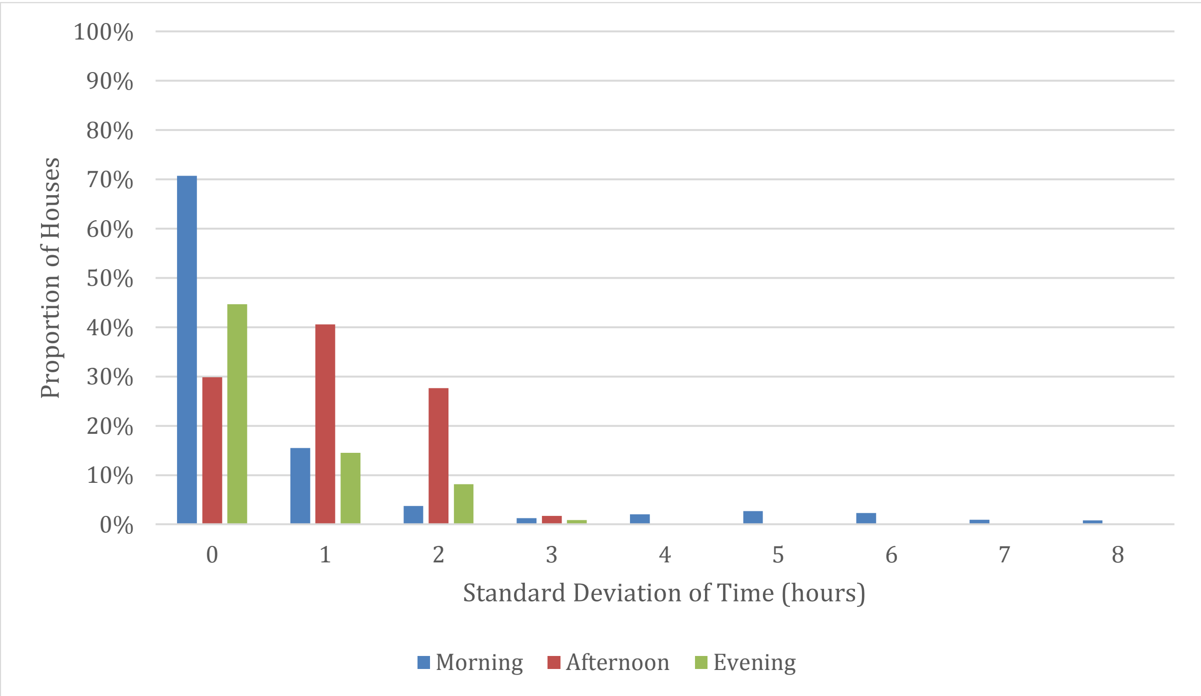


Figure 5.4: Variability of departure times at different times of day for week days (sample size: 64,495 households).

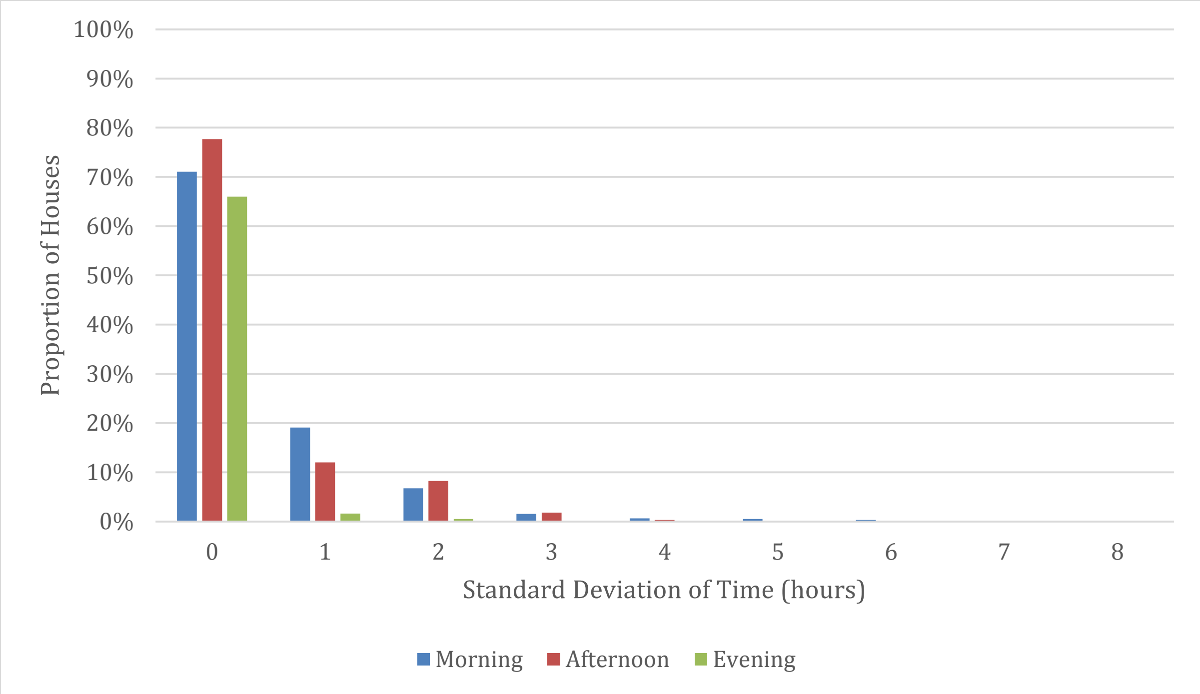


Figure 5.5: Variability of arrival times at different times of day for weekend days (sample size: 64,495 households).

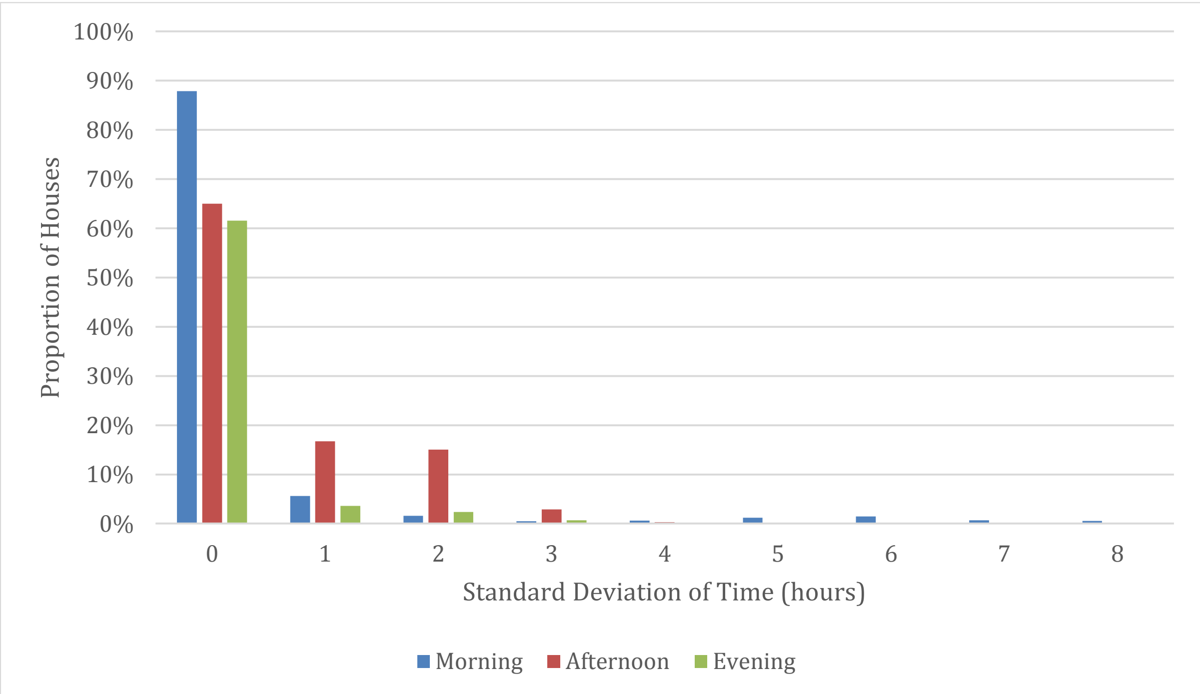


Figure 5.6: Variability of departure times at different times of day for weekend days (sample size: 64,495 households).

5.1.2 Household structure

Analysis of arrival and departure times based on household structure shows that retired households tend to leave home later in the day and return home earlier. In addition, households with children tend to leave home later in the morning (by 30 minutes to 1 hour). There are clear implications for both energy use and HEMS control strategies.

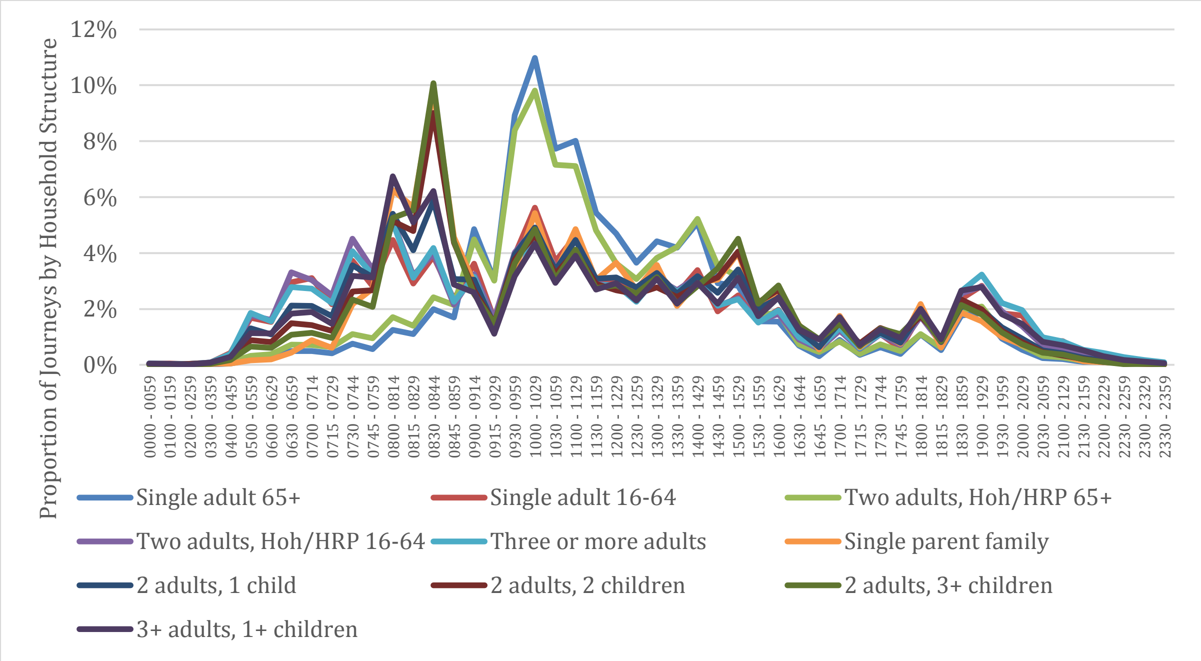


Figure 5.7: Home departure times for different household structures (sample size: 64,495 households).

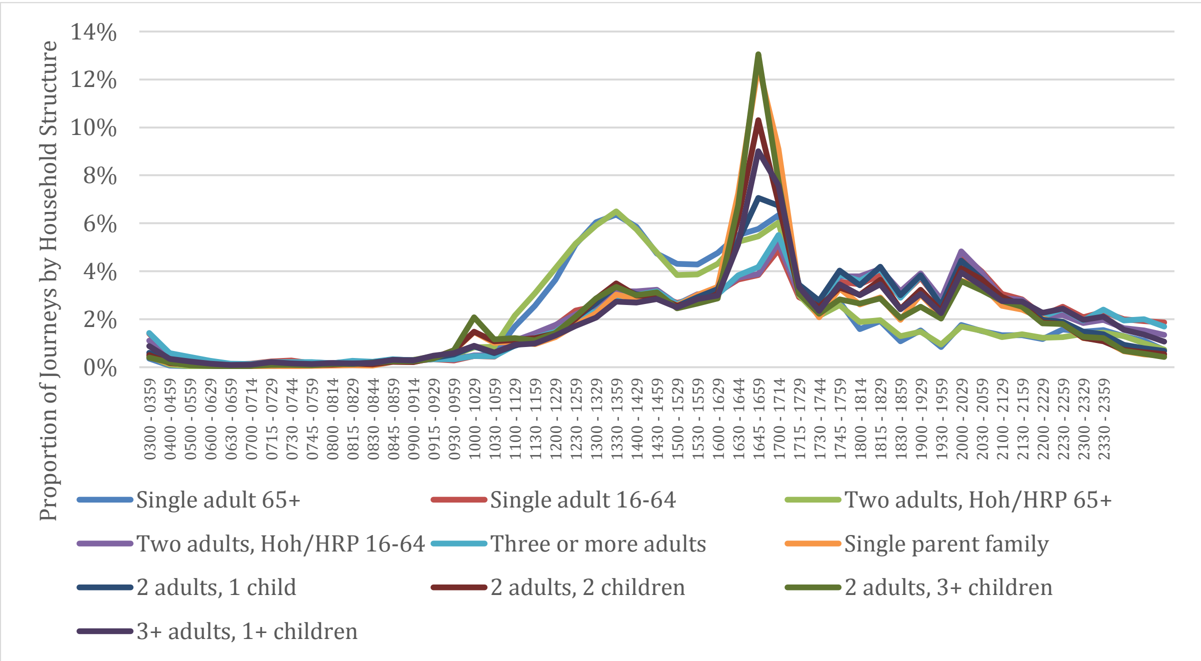


Figure 5.8: Home arrival times for different household structures (sample size: 64,495 households, 1.24 million journeys).

5.2 Journey Time to Complete

The length of time a journey home takes to complete has implications for HEMS strategies. It has been suggested that heating systems could be switched on when householders commence their journey home to minimise unnecessary heating. An analysis of the journey time of the first person home (figure 5.9) suggests that this strategy would not be appropriate in a UK context as over 80% of all journeys are less than 30 minutes long. This is insufficient time to heat a typical UK house. Figure 5.10 shows that people with longer journeys home tend to arrive later. For this relatively small group the option of switching the heating on as they start the journey home may be possible.

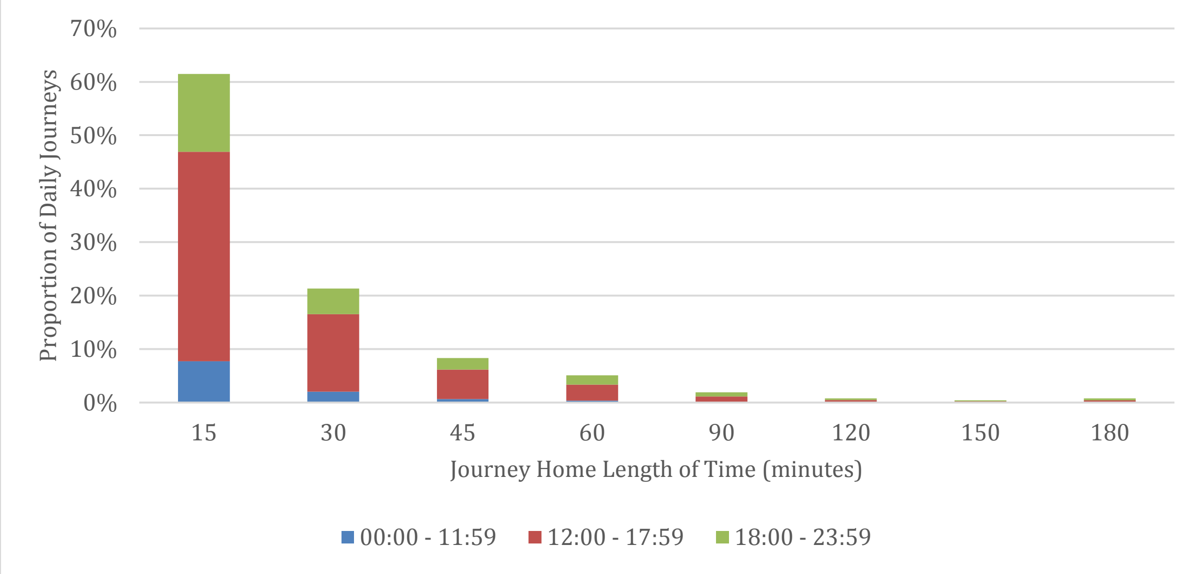


Figure 5.9: Length of time for journeys home for the first person home by time of day (sample size: 285,618 journeys).

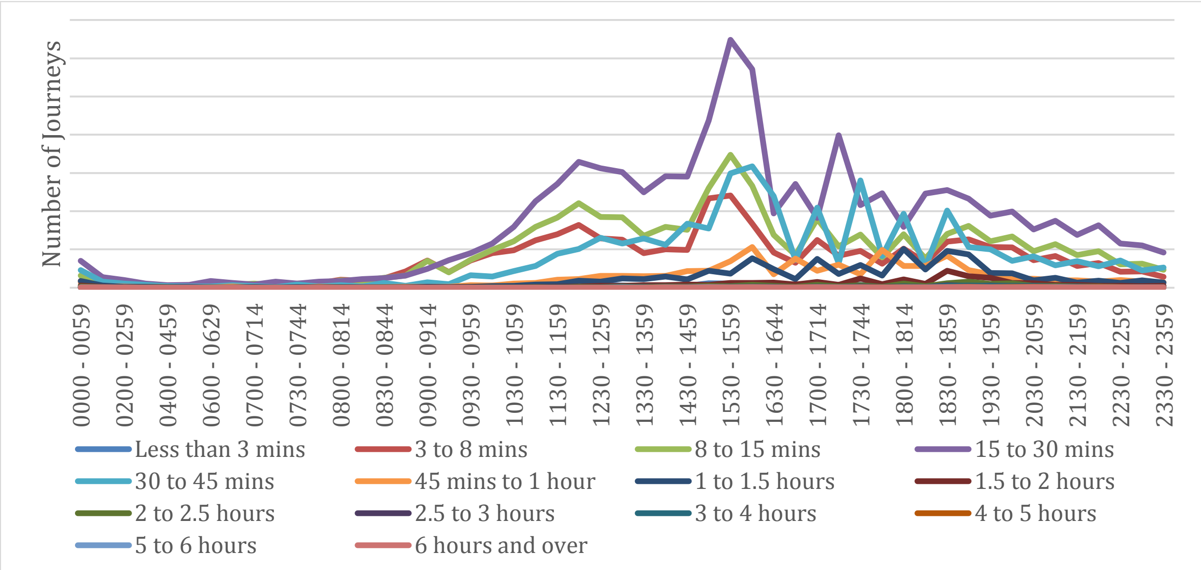


Figure 5.10: Length of time for journeys home by time of arrival (sample size: 64,495 households, 1.23 million journeys).

5.3 Journey Origin

The start point for a journey home may influence the requirement for heat at the end of the journey. For example, after taking exercise a person may not want the house to be as warm but they may want hot water available. Journey origins for the first person home are very different between week and weekend days (figures 5.11 and 5.12).

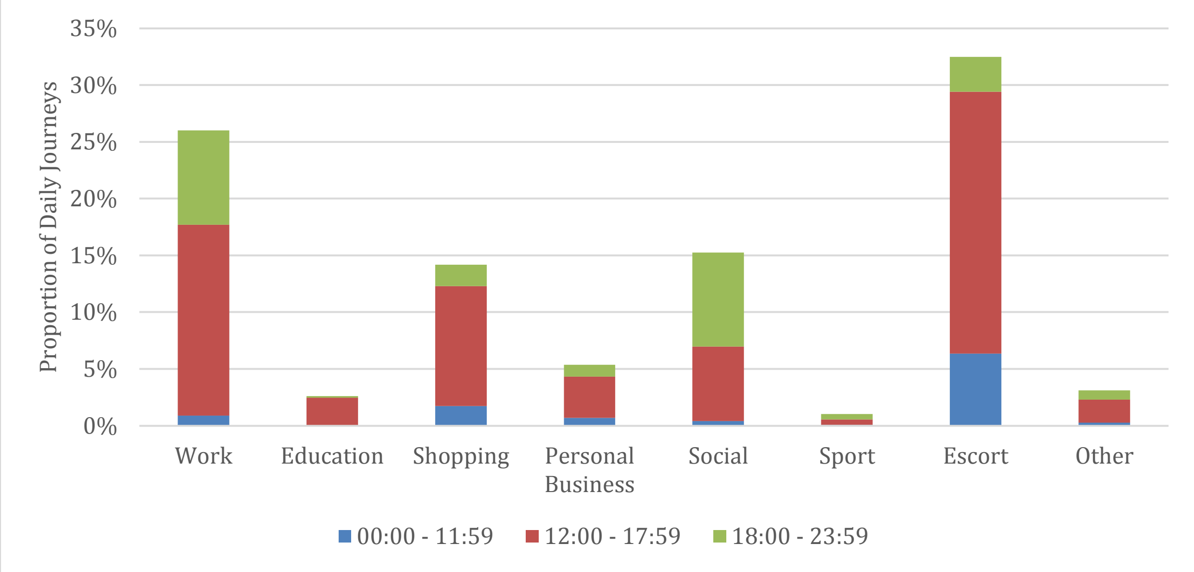


Figure 5.11: First person home journey origin for week days for different times of day. (sample size: 214,086 journeys)

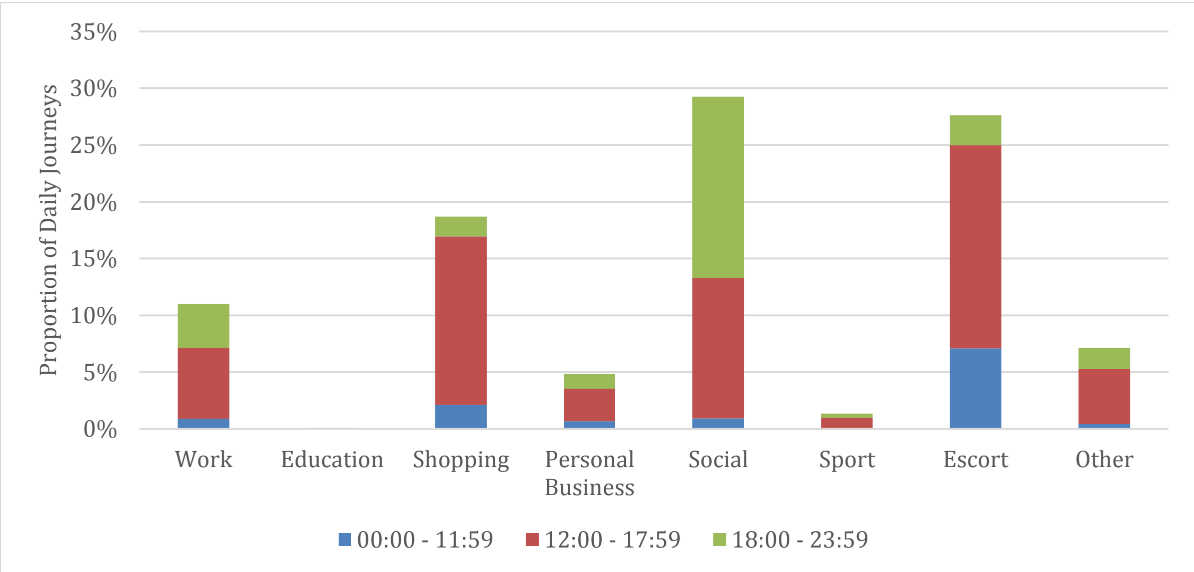


Figure 5.12: First person home journey origin for weekend days for different times of day. (sample size: 71,532 weekend journeys)

5.4 Journey Mode

The mode of transport for the journey home may influence the demand for heat on arrival. People who walk or cycle to home (around 13% of journeys home) are likely to be warmer than those who have used some form of motorised transport. They may require lower ambient temperatures and hot water to be available. Over 80% of journeys home involve some sort of motorised transport. These people are likely to want temperatures at their normal comfort level. There is no difference between the mode of transport used to get home between week and weekend days.

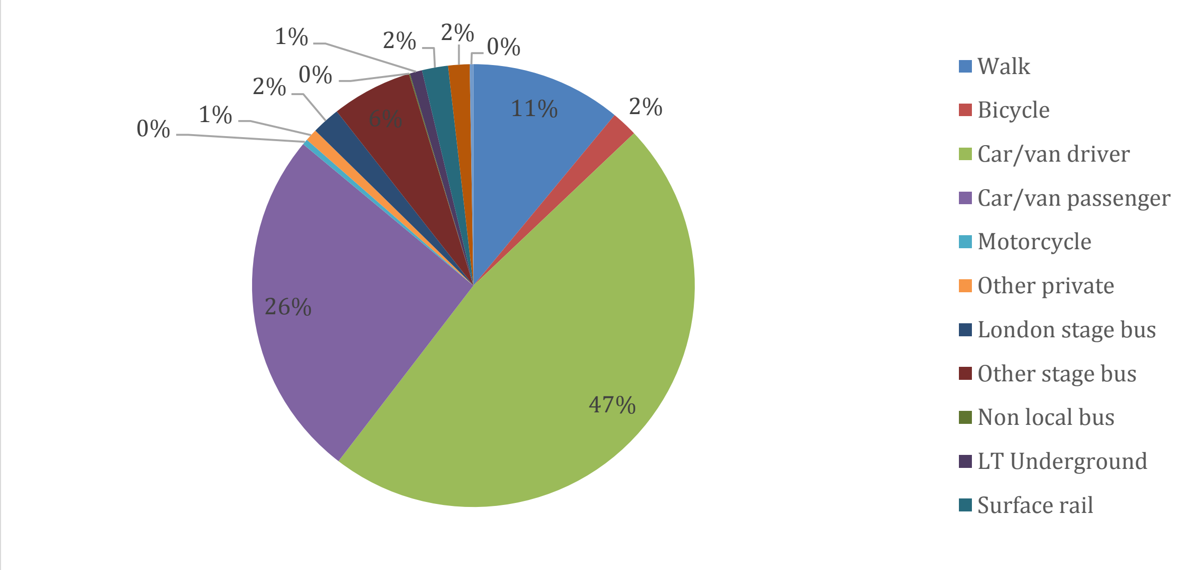


Figure 5.13: Journey home mode for all journeys home (sample size: 1.25 million journeys).

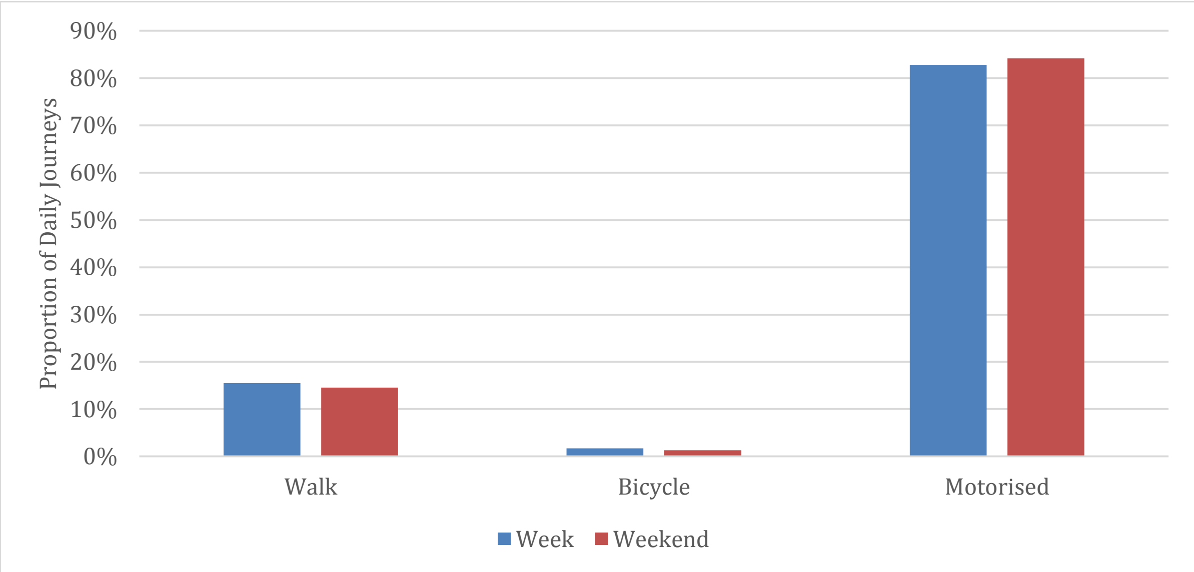


Figure 5.14: Journey home mode for the first person home (sample size: 214,086 week day journeys 71,532 weekend journeys).

5.4.1 House Type

People living in smaller properties are less likely to use motorised forms of transport to get home. Those living in detached properties are most likely to travel home by car.

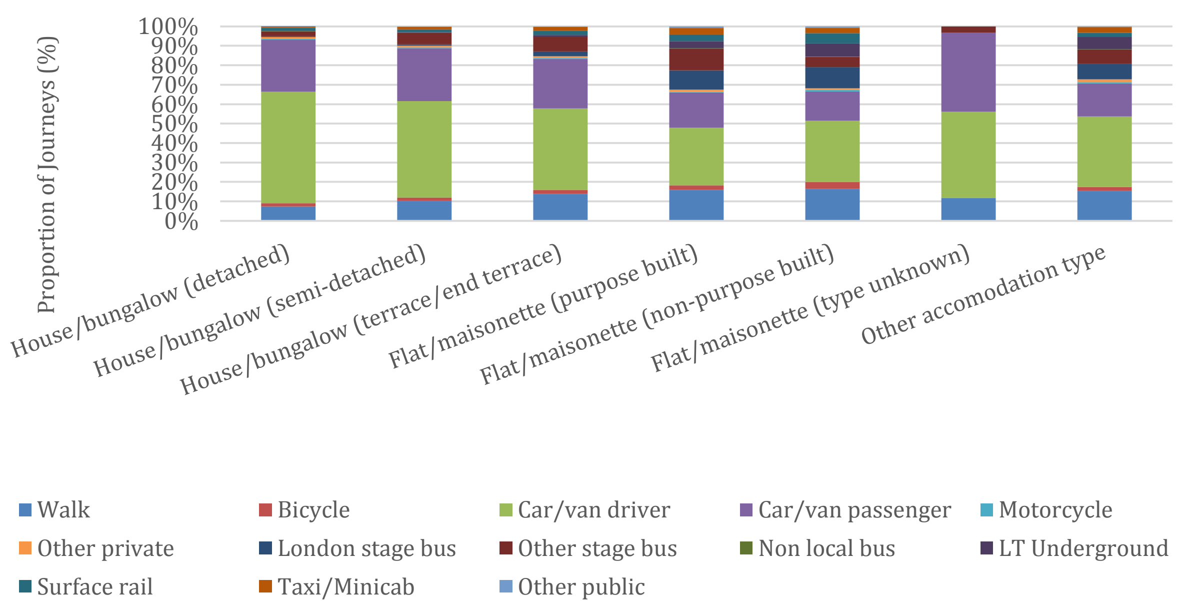


Figure 5.15: Journey home mode by house type (sample size: 1.25 million journeys).

5.4.2 Household Structure

Single parent families are most likely to walk to get home.

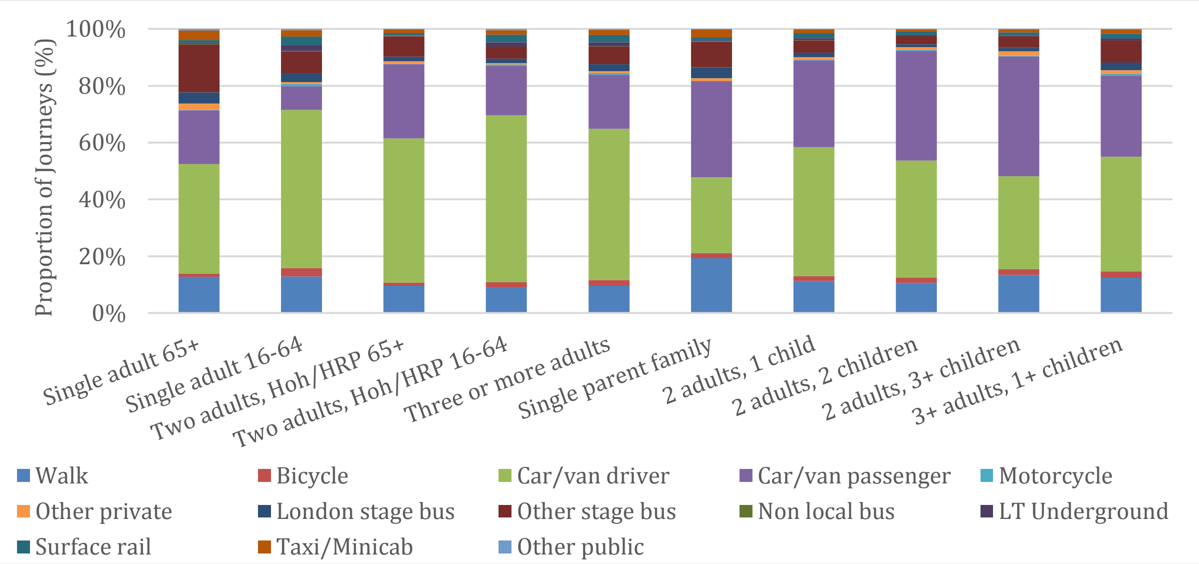


Figure 5.16: Journey home mode by household structure (sample size: 1.25 million journeys).

5.4.3 Government Office Region

Little difference can be seen in the proportion of journeys home by foot or on bicycle between different government office regions.

5.4.4 Area Type

The proportion of journeys home by foot is slightly lower in rural areas but the difference is small enough that it is unlikely to have much of an influence on heat demand.